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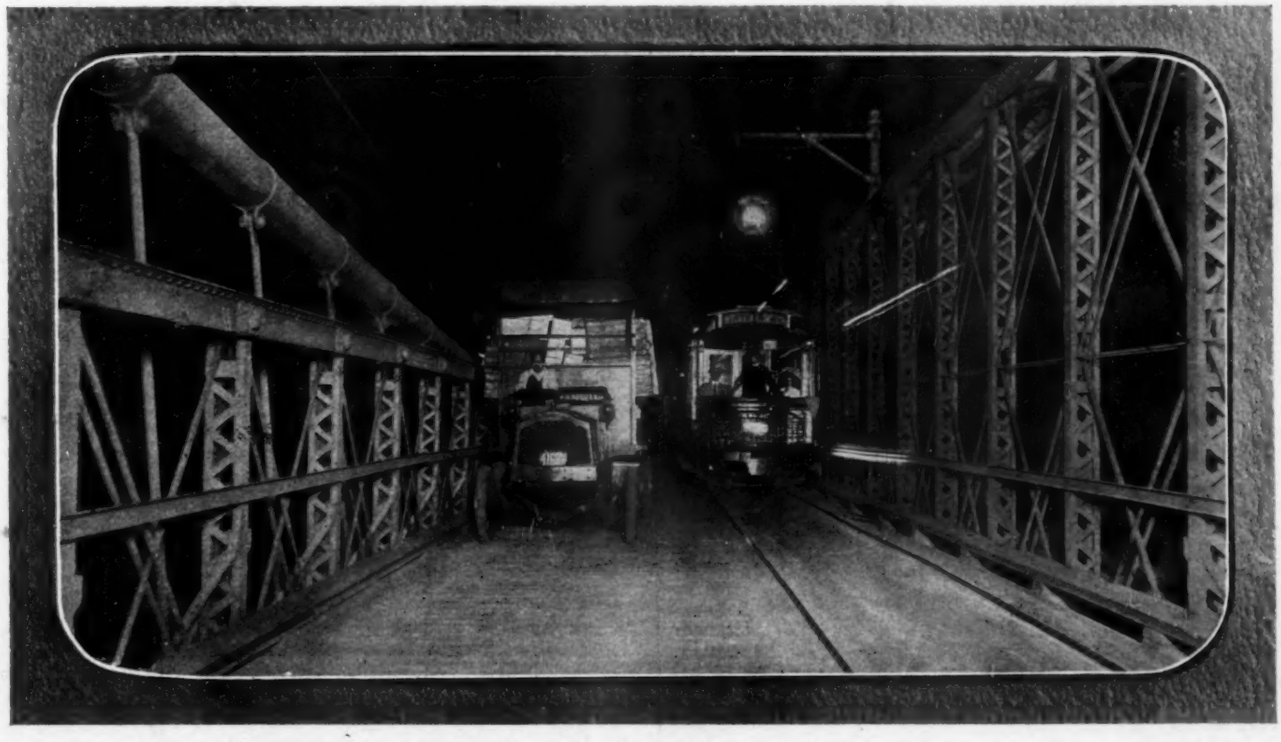
THE AUTOMOBILE

Freight Automobile Service

Organizing a Systematic Plan--Giving Forms

Suggesting a complete and systematic method of controlling the activities of freight automobiles in regular service, showing forms of routing the freight automobiles, keeping track of their maneuvers, and recording the items of expense, telling the workmen of the duties for which they should be held responsible, and indicating to the heads in their various capacities how they can obtain the best result and how errors may be detected at inception, rather than to discover when it is too late that the cost is excessive, and that the result falls below a fitting level.



FREIGHT AUTOMOBILE CROSSING THE BRIDGE FROM THE DARKNESS OF RULE-OF-THUMB TO ORGANIZED METHODS OF CONDUCTING THE ENTERPRISE—SUCCESS LIES IN ITS SAFE TRANSIT

SUCCESS is the ripe fruit of a well-pruned tree, counting a single measure, and it is within the ability of a man of mediocre attainment to obtain this quota; but if a plurality of successes are to be pyramided the orchard must have many trees and organization must attend the efforts of the caretakers, or disease will fasten its fangs upon the neglected part, and, this disorder being contagious, it will spread throughout the length and breadth of the orchard, slowly but surely migrating to the roots of the trees, sapping their vitality, and the crash of the project as it comes down will signal the end of the effort in the regular course of events.

Many merchants are standing on the brink of a precipice, and they are threatened by a force that they are not preparing to meet. Referring to the delivery of goods in a large way, it is not difficult to discover commercial houses whose fleet of delivery wagons reaches three figures and beyond, and under the old regime, limiting this work to horse-drawn vehicles, an automatic organization grew up and it prospered in a sense, but with the coming of the freight automobile merchants lagged, rather with the expectation that their neighbors in the same business could make mistakes that they might take advantage of. The time arrived when the merit of mechanical transportation crushed the inertia of the old idea, and the new type of vehicle

was pressed into service under the force of circumstances.

It is this force of circumstances that has hidden the advantages of system, and the purchasing of sample automobiles at first, putting them into use in conjunction with horse-drawn vehicles, seemed a logical thing to do. Of the failures that the records show there are none that may not be traced to the ramifications of this logic—lack of capable organization was at the bottom of the disorder.

It takes just as good a man to run one freight automobile as it does to operate another car of the same generic type. This principle has been lost sight of during the exigencies of a preliminary situation, and the result was that the men who operated animal transportation looked upon the freight automobile as a side issue, some of them thinking that it was a fad, and others viewed it with indifference; at all events, the freight automobile situation fared badly in the hands of these horse-men, and the idea that an organization along mechanical lines would have to be contrived never occurred to them.

Fortunately for the automobile transportation idea, there are companies in America whose business is always done along systematic lines, and the heads of these concerns were alive to the fact that it takes a banker to run a bank, or a farmer to operate a farm, and while horse-men are the best talent in their zone of activity, none of these divisions of men will serve efficaciously in the newer field.

A Mechanical Organization is Necessary Independently of the Number of Automobiles Used

As a primary basis of operation it is necessary to establish a system including a mechanical department if freight automobiles are to participate in an effort, and it is self-evident that the cost of operating freight automobiles, counting the "overhead," will decrease with the number of the cars in actual service. It is on this account that the records of the cost of delivering goods, if they are hodge-podge, including horse-drawn vehicles and freight automobiles in the same category, will be valueless.

In the light of experience it would seem to be indicated that the freight automobiles, if they are used in conjunction with horse-drawn vehicles, should be operated as a separate enterprise, and their maneuvers should be segregated out, taking advantage of the wider radius of action of the automobile and limiting the operations of the horse-drawn vehicles to a relatively narrow zone. It is a misfortune, perhaps, that the theory of an organization is exactly the same with one automobile as it would be with one thousand automobiles. If there is a mechanical department there must be a man at its head; in other words, an executive engineer. If the executive engineer has but one automobile under his care he may become the driver thereof, but he is nevertheless the executive engineer for a part of the time, and he is the executive engineer combined with the driver for the other part of the time.

Suggesting a Plan of Organization That Has Worked Out in Practice in Both a Large and a Small Way

Regarding it as self-evident that a broad plan of operation is more necessary to a merchant than the single automobile that he takes on trial, it remains for him to scheme out the whole project, taking into account the initial effort involving a single automobile and the ramifications incidental to the further advancement, so that the single automobile first taken may be operated under healthy conditions, and the growth in the number of the cars as they are purchased and put into service will be along safe and conservative lines. The scheme that seems to work best and one that has been tried out under exacting conditions is suggested in the "operation diagram," as here presented, in which the executive engineer is the head (1), sub-dividing his efforts as follows:

(2) Engineering department; (3) purchasing department; (4) construction department; (5) stock department; (6) accounting department; and (7) operating department.

In the engineering department (2) investigations of the capabilities of the various makes of automobiles for the type of service that is to be performed would necessarily be looked into, and observations would be made of cars in service in order to be able to show to what extent and in the precise way that purchases might be made, and how the automobiles so purchased should be put into service with the idea that the investment would be conserved and the work would be done expeditiously and well.

The purchasing department (3) would act, no doubt, under the direct supervision of the head of the financial department of the company, but in the purchasing of automobiles the specifications of the executive engineer, coming from the engineering department, should be binding upon the activities of the purchasing department.

The construction department (4) might be in the establishment of the maker of the automobiles that the purchasing department (3) might contract for. But no matter where the automobiles are made, this place becomes the construction department (4) of the establishment under the direct supervision of the executive engineer (1), it being the idea that the executive engineer of an operating company is as much concerned about the make and ability of the automobiles that are to be used, if they are the product of an outside builder of cars, as he would be if they were built in a plant of the operating company's own devising.

The stock department (5) would have charge of the accessories, including tires, lamp equipment, repair parts, etc., of all of the operating automobiles, and of new cars prior to their being put into service. The thousands of dollars that can readily be dissipated if a plurality of men are permitted to go to a storeroom and take supplies haphazard debars a careful merchant from the reckless privilege of operating any number of automobiles without organizing a stock department.

If it is necessary to proceed at all along the lines as here indicated, to have an accounting department (6) is a settled fact.

Having provided for the purchase of the right kind of automobiles, giving to the purchasing department a definite line for its guidance, controlling the activities of the furnisher of the cars, in other words, the construction department, keeping track of the stock and accounting for everything in the most approved form brings the organization up to the point where the operating department (7) may be set into motion.

Differentiating Between the Establishing of Assets and the Creating of Liabilities

Up to the time when the operating department is set into motion, if the organization is an efficient one, the combined effort is for the purpose of establishing assets, it being the case that a good freight automobile costs no more than its market value, and it is a fair assumption that the purchase price will be regulated to accord with the value. But instantly the operating department takes hold of the automobiles, putting them into regular service, a liability is being created, and it is in this division of the total effort that most failures are made.

If the executive engineer is capable of supervising the departments, controlling their activities up to the time of the purchase of the automobiles, it is true that he will be the best man to be given charge of the general supervision of the operating department, but it would be an unwise proceeding to hamper the activities of an executive engineer to the extent of making him do the "wagonmaster's" work. On the other hand, it should be the duty of the wagonmaster to conform to the regulations as they are outlined in the engineering department, taking the automobiles as they are purchased, referring all costs to the accounting department, doing the work as indicated by the delivery department of the main enterprise, not forgetting that records (72) must be kept of every activity, so that the engineering department (2) would be kept in a position to benefit by experience.

A further examination of the operating diagram shows the sub-divisions of the engineering staff work as follows:

(2) Engineering department—designing (21), material list

OPERATING DIAGRAM—SHOWING THE STAFF CONNECTIONS, DEPARTMENTS AND SUBDIVISIONS IN THE OPERATION OF AUTOMOBILES UNDER THE DIRECTION OF THE EXECUTIVE ENGINEER.

- 1 — Executive Engineer
  - 2—Engineering Department
    - 21—Designing and drafting:—
      - 211—Records
    - 22—Material list:—
      - 221—Pattern records
      - 222—Specifications
    - 23—Experimental work:—
  - 3—Purchasing Department
    - 31—Orders for material (purchased):—
    - 32—Pricing of requisitions:—
      - 311—Cost of supplies (record)
  - 4—Construction Department
    - 41—New work:—White
      - 411—Supplies and material
      - Labor:—
        - 412—Machine work
        - 413—Carpenter work
        - 414—Smith work
        - 415—Painting
    - 42—Repairs to Wagons:—Blue
      - 421—Supplies and material
      - Labor:—
        - 422—Machine work
        - 423—Carpenter work
        - 424—Smith work
        - 425—Painting
    - 43—Shop Equipment:—Jigs and tools:—White
      - 431—Supplies and material
      - Labor:—
        - 432—Machine work
        - 433—Carpenter work
        - 434—Smith work
        - 435—Painting
  - 5—Stock Department
    - 51—New Work:—White
      - 511—Raw material
      - 512—Finished material
    - 52—Repair work:—Blue
      - 521—Raw material
      - 522—Finished material
    - 53—Tools (perishable):—
      - 541—Machine tools, etc.
      - 542—Permanent improvement
      - 543—Jigs, etc.
      - 544—Patterns
    - 54—Shop inventory:—
  - 6—Accounting Department
    - 61—Records:—
      - 612—Time—labor
      - 613—Orders
      - 614—Cost
      - 615—Shop or overhead expenses
  - 7—Operating Department: Green
    - 71—Sub Stock Room:—(Repair Parts of Wagon)
      - 711—Raw material
        - 721—Current consumption—each wagon
        - 721—Mileage—each wagon
      - 712—Finished
        - 722—Pieces picked up
        - 722—Pieces delivered
        - 723—Route schedule
        - 724—Battery mileages—(by number)
        - 724—Battery rejuvenation—frequency, cost
        - 724—Battery rejuvenation—cost, upkeep
        - 725—Casualties each wagon—time lost
        - 725—Casualties each man—time lost by wagon
        - 726—Material used—each wagon
        - 726—Labor used—each wagon
        - 726—Cost of each kind of part used on each kind of wagon
      - 73—Inventory: Book No.
        - 731—Tools and fixtures
        - 732—Permanent improvement
        - 733—Garage equipments
        - 734—Perishable improvement
        - 735—Rolling stock and tools and repair parts on each wagon
        - 736—Batteries
        - 737—Battery accessories
    - 72—Records:—Green

(22), and experimental work (23) are handled direct, and it follows that records (211) pattern records (221) and specifications (222) would sub-divide in the wake of these departments.

(3) Purchasing department would have at its hand orders for material (31) and the pricing of requisitions (32), and following these sub-divisions would come (311) of the cost of supplies (records).

(4) Construction department would have three main sub-divisions, including new work (41), repairs to wagons (42) and shop equipment, including jigs and tools (43). The support of the activities of the sub-divisions of the construction department would require further sub-divisions involving labor for new work, as supplies and material (411), machine work (412), carpenter work (413), smith work (414) and painting (415).

In the same way involving repairs to wagons, the sub-divisions would be, supplies and materials (421), machine work (422), carpenter work (423), smith work (424) and painting (425).

The last sub-division in the construction department (4) supporting the activities (43) involves labor, including supplies and material (431), machine work (432), carpenter work (433), smith work (434) and painting (435).

It will be seen that the same generic types of items reoccur in the several departments, and while it is desirable to sub-divide between new work, repair work and shop equipment, it will be understood, nevertheless, that there is a strong reason why the construction department (4) should have immediate charge of this series of activities. Under any other plan confusion would come in the machine shop, carpenter shop, blacksmith shop and paint shop, or there would have to be departments of these types separated from each other for the new work on the one hand and the repair work on the other, with a general misunderstanding as to what constitutes shop equipment, jigs, tools, etc.

It will be observed that a distinction is drawn between the operations of the construction department (4) and the stock department (5) as regards the supporting divisions, and in the stock department the sub-departments co-operating are: New work (51); repair work (52); tools (perishable) (53), and the shop inventory (54).

In the operation of the department of new work (51) under the direction of the stock department (5), raw material is given a number (511) and the finished product is cared for in (512). In like manner for the repair department (52) raw material takes (521), and the finished product is handled under (522). The shop inventory (54) is sub-divided into machine tools (541); permanent improvement (542); jigs, etc. (543), and patterns (544).

In the accounting department (6) the records (61) are subdivided as follows: (612) time and labor; (613) orders; (614) costs, and (615) shop or overhead expenses.

In the operating department (7) a sub-stock room (71) is organized to carry the repair parts of the wagons in operation, and in this room the raw material (711) is kept separate from the finished product (712).

The records (72) of the operating department (7) are subdivided as follows: (721) electric current consumption for each wagon, and the mileage attained.

(722) nature of the freight and number of pieces picked up, also the number of pieces delivered.

(723) route schedule of each wagon.

(724) covering the battery mileage, each battery to be numbered, battery rejuvenation including a statement of the number of applications of the current and the cost thereof, also the battery cost, keeping a separate itemized statement of the upkeep thereof.

(725) takes care of casualties involving each wagon, with a separate item of the time lost in consequence, also the casualties to each man, including a statement of the time lost by wagons as a direct result.

(726) accounts for the material used for each wagon, giving a statement of the labor expended, and the cost of each kind or part used on each kind of wagon.

(73) representing the inventory book, refers to the divisions of the same as follows: (731) tools and fixtures; (732) permanent improvement; (733) garage equipments; (734) perishable improvement; (735) rolling stock and tools, noting repair parts on each wagon; (736) batteries, and (737) battery accessories.

In the working of an organization as outlined in the chart, a card system may be readily contrived, and, as the chart indicates, the cards and order blanks should carry distinctive colors, the idea being to facilitate the handling of the system, making it possible for a man of no great skill to keep the records in an orderly way, permitting him to respond to demands with promptness, and to maintain the system on a basis of accuracy.

Organization containing general instructions and forms:

The colors of stationery proposed is as follows: White—Shop equipment, tools, jigs, etc. Blue—For the shop repair work.

In the event of accident to a wagon, a full detailed and written report shall be made by chauffeur to supervisor of automobiles, giving the detail of the injury to the company's wagons or property, as well as injury and damage, if any, to the property belonging to others. Minute detail must also be given in the case of any casualty to individuals.

Upon repairs or adjustments being required upon any wagon, chauffeurs are required to make a brief written statement of their opinion as to the cause of trouble, which statement is to be handed to the supervisor of automobiles, who will write orders to the shop for repairs to be made by the shop which will issue shop orders.

Shop Order		Authority for Issue
Specifications in Brief		To
	For.....	
So. No.	Received.....190..... Completed.....	Approved

In the event of the chauffeur being unable to make written report to the supervisor of automobiles he is to make written report to the shop foreman, who will immediately issue shop order in all cases, giving brief and concise instructions thereon.

All shop orders which may be issued shall have noted thereon the time of beginning work and the time of completion, and copies must be handed to each department interested.

Foremen are required upon it becoming necessary to do any new work to examine carefully report of chaffeur and amplify same in a report of his own after having made a critical examination of the reported trouble, and immediately make out shop order and requisitions covering all repairs required to remedy all trouble, giving engineering department or drafting room such information, etc., when necessary.

Employees are required to report upon entering or leaving the shop.

In cases of absence, the foreman is required to note on a time card full detail as to the cause and other pertinent data.

The foreman is to secure data as to the time of employees on each shop order, stating shop order number and other pertinent data as follows:

No.....

Time Slip

Name..... .....19.....

Nature of Employment				Number of	
				Pieces	Hours
Verified by	Charge to				
	S. O.	W.	Part No.	AMO $	UNT Cts.
	Make 1 entry only on 1 slip				

Labor—Daily Distribution

The accounting department (612) shall enter in a labor daily distribution book the names, numbers and rate per hour of each employee, the number of hours each may have been employed upon each shop order, and extend the cost in each instance.

The "productive labor" and the "overhead" employees shall be grouped in making entries, then "overhead" expense shall be prorated to both the "labor" and "material" accounts, and fur-

ther posted to a semi-monthly summary. This data is to be posted to the account to which it is chargeable, but for the time being we will not prorate on account of "material." From this record the pay roll distribution of labor is to be compiled.

Employees' Record

This should include names, addresses, references and record.

Date.....19.....

DAILY LABOR DISTRIBUTION

										TOTAL	
Hrs.	Cost	Hrs.	Cost	Hrs.	Cost	Hrs.	Cost	Hrs.	Cost	Hrs.	Cost

On every shop order before being closed a note must be made as to the name of the individual who certifies to the fact that a thorough inspection has been made, and that the wagon is in a good operative condition. If this cannot be certified to, notes are to be made as to the inspector's qualifications as to his certification.

There shall be a record kept of the detail of all faults known to exist with each wagon, and when wagons may come into the shop this record must be examined and attention given to each item, with a view of a complete and satisfactory remedy of each, as follows:

RECORD	Date

There shall be a card index made of patterns, giving full details as to names, numbers, etc., and there shall be also entered thereon the costs taken from the bills as rendered by the pattern maker. Pattern makers shall be required to enter on bills full detail as to the pattern number, drawing number, etc. Pattern numbers shall be identical with the piece number when possible.

Numbers taken from drawings when possible shall be clearly stamped or otherwise, as follows:

RECORD	Date

A shop order is to be issued for every piece of work or job by the proper authority. Copies of same are to be issued to each department interested, giving special instructions in each case when necessary or possible.

Should the shop order call for new work, the engineering department shall immediately make specifications, drawings, material lists, etc.

Material list shall take the following course: From the designing and drafting department (21) to the executive engineer (1), to construction department (4), to stock department (5), who will check material in stock and reserve for the specific shop order number. Then to "records" (221), which will check off and locate patterns and give shipping instructions for same, if any, and attach full detail to material list; then to purchasing department (3), which will immediately proceed to order material necessary, furnishing stock department (5) with material list and carbons of orders, retaining one copy for himself. Then upon receipt of material it must be invariably checked up with all the orders as material comes in, and reserved for the job for which it was ordered.

Each wheel should have a number assigned to it. All tires applied to this particular wheel should be kept on the attached form.

TIRE DATA

FRONT OR REAR Size.....City..... Sheet No..... Wheel No.....

Make	Tire No.	Wagon No.	Mileage	Put on	Taken Off	Req. No.	Remarks

The stock card of material, both finished and raw, shall be filed under general stock account or under the specific shop order for which it may have been assigned or charged.

The stock department (5) shall make entries on the stock card as to the number of bins or tills in the stock room in which stock is stored.

Purchasing department (3) shall issue all orders for supplies, etc., on duplicate forms designed for that purpose, as follows:

No. G..... S. O. No.....

MARK THIS ORDER NUMBER ON ALL PACKAGES .....190.....

PLEASE SHIP THE FOLLOWING, VIA

PRICE F. O. B. DELIVERY EXPECTED

THIS ORDER IS GIVEN WITH THE FOLLOWING INSTRUCTIONS AND CONDITIONS:

1. In all correspondence regarding this order invariably mention order number which MUST ALSO BE SHOWN ON INVOICE.
2. We will pay no charges for boxing or drayage.
3. When your account is due we will mail your settlement. Drafts will not be honored under any circumstances.
4. If prices were not agreed upon in advance they must be the lowest obtainable in the market at date of shipment.
5. If this order specifies that an article composed of several parts is to be furnished complete without mentioning each item you accept this order conditional upon the several parts being susceptible of assembly in such manner as to properly perform the service intended without alteration or the addition of other parts.
6. It is important that all bills for our account be rendered in DUPLICATE. To prevent loss or delay in transit, we require that when loose articles are tagged for shipment each piece be marked and railroad or express receipt be marked in the same way.

(Signed)
Per
Purchasing Agent.

.....

PLEASE RETURN THIS SLIP IMMEDIATELY, OTHERWISE OUR RECORDS WILL BE INCOMPLETE

INSTRUCTIONS.—Kindly DATE, FILL OUT AND SIGN, stating DATE you will ship. Be specific. "Promptly," "at once," or "soon as possible," etc., will not answer our purpose. If you cannot ship complete order at one time, state exactly what you can ship and when.

.....190.....

Gentlemen:
We have this day received your order No. G....., dated.....
and will ship from.....as follows:
.....
.....
.....
This order will be executed in accordance with the conditions stated.
Respectfully,
....

The stock department (5) shall check up purchasing orders as material is received, and also check material list as material is received. A debit and credit record on cards of material as delivered or received should be kept. When all material required for shop order has been received the material list shall be handed to the construction department (4), which will make out requisitions on stock room, and should any excess be drawn from the stock room the balance should invariably be returned to the stock department (5) and credited to the shop order number. Then all excess of material shall be charged to general stock account as follows:

ARTICLE		COST				MAX.	MIN.

Date	For	S. O. No.	Rec'd	Taken out	Bal. on hand	Value

The purchasing department (3) shall require all supply houses to present bills in duplicate and require them to follow in detail the instructions on the orders.

Upon receipt of bills, the original and duplicate shall be checked up by the purchasing agent (3) from information received from stock room as to the receipt of the goods. Then they shall be checked carefully as to price and handed to chief engineer (1), who will O. K. and forward to the treasurer.

The duplicate shall be certified to as a true copy and filed in the purchasing department (3) for record as to cost, etc.

Checking should be complete before any material may have been used.

Records of the cost of material, both finished and raw, should be kept by the stock department (5) upon cards and indexed under minute subdivisions, as follows:

RECORD	Date

It has been found convenient to use the following form for the above purpose, all entries of material and labor being posted from various sources to a single account under a shop order number. The form, as follows, is a standard stock form:

Date Sold		Folio
	No..... Salesman.....	
	Sold to.....	Date Billed
Terms	Town and State.....	
	Ship by.....	Ledger

Shipper's Check	Quantity	Register No.	Weight	Price	Salesmen Must Not Use These Columns

On all drawings there shall appear a table giving a detailed list of quantity of all the material required to make up parts, as shown in the drawing. The complete material list will be made up of the classified items of the drawing list.

All drawings are to be numbered consecutively.

The sizes are to be standard, either 26 x 36 inches, numbered L....., or 18 x 26 inches, numbered S....., or 13 x 18 inches, numbered T..... On the reverse of the drawing should be pasted the following notice:

This drawing is filed for the purpose of a permanent record of the engineering department and is not to be removed without special instructions.

All hand tools, jigs, etc., including such supplies as sand paper, drills, taps and dies, and all gauges and tools, perishable or otherwise, shall be kept in the tool room and not removed from their assigned locations therein without the mechanics first having given a metallic numbered check (which is provided) as a receipt for the same. This check is to be hung on a hook and not be returned to the mechanic until it may have been satisfactorily accounted for.

All tools shall be numbered when possible and a description, with cost and other pertinent data, entered on proper card form made for the purpose.

This card is to be preserved and a full record of the history of the tools kept thereon.

The description and value of the tool should appear on the "inventory."

Requisition received by the stock department (5) from foreman shall be filled from stock if possible, although material received and reserved for some special shop order should not be used for this purpose. Upon its being learned that material is not in stock, foreman should be advised to that effect, and requisitions are to be presented to the stock department (5), then, if necessary, to the purchasing department (3), and material ordered.

PURCHASING DEPT. DR. or CR.

.....MATERIAL

NO..... .....19.....

QUANTITY Assumed		A
		Req'd by.....
		Ord'd by.....
		Pur. by.....
		Rec'd by.....
		Checked by.....
		Entered by.....
PRICE UNIT	☞ MAKE ONLY ONE ENTRY ON THIS SLIP	
AMOUNT	S. O.	
$ Cts.	Credit to	
	Charge to	

STOCK DEPARTMENT

Material Slip No.....

.....19.....

Quantity	Description	Price

Applied by

An inventory shall be kept of all property belonging to the company under the headings of Permanent Improvements, Perishable Improvements, Tools and Jigs, and all items, whether purchased or made, shall be charged up on this inventory.

The value of every article based on information received from bills or from cost records under specific shop order numbers shall be entered.

INVENTORY..... Page.....

Sheet No..... Priced by.....

Called by..... Department..... Extended by.....

Entered by..... Location..... Examined by.....

Check	Quantity	Description	Price	Extensions

Men or chauffeurs who are employed to operate the various automobiles are required to meet with the approval of wagon master as to their capabilities in matters of the operation and handling of apparatus to which they may be assigned, and they are further required to report to the superintendent of wagon service for the approval as to their qualifications and capabilities in connection with his department, the superintendent of wagon service having sole authority of employment and dismissal.

The wagon master has the authority at any time to withdraw his approval as to the capabilities of men already employed, and upon his calling the superintendent of wagon service's attention to the fact the men should, of course, be taken off the automobile service as chauffeurs.

Should the automobile to which some operator may have been

assigned be withdrawn from service, the operator should in each and every case report to the superintendent of wagon service to be used to crew a horse wagon or for any other service which the superintendent of wagon service may require of him.

In the event of the superintendent of wagon service not having work to which the employee may be assigned, he is then to report to the shop foreman, and in the event of his being unable to use him he should be temporarily laid off.

When chauffeurs may be assigned to duties other than that of operating automobiles they are to continue to receive pay at the rate at which they may have been originally employed, irrespective of the nature of the work which may be assigned to them.

Pertinent Communications

Editor THE AUTOMOBILE:

I am interested in sleeve types of motors, especially the Knight idea, and I would like to know from you whether or not the Knight patents are so complete that it will be impossible to circumvent them. Is the English Daimler motor of the Knight make up to date? J. F. O'D.

Brooklyn, N. Y.

According to the reports in the English papers, Charles Y. Knight is still active in the matter of patents on motors of the sleeve type. The latest report, reprinted from *The Autocar* of May 13, is as follows:

Among the patent specifications just to hand is one by Mr. Charles Y. Knight covering improvements on the double sleeve slide-valve engine, which has been on the market for close upon three years. The specifications set forth the objects of the improvements, which are (1) to eliminate any possibility of the valves binding during the firing stroke, (2) to ensure a supply of fresh mixture to the proximity of the sparking plug, and (3) to allow the outer sleeve to expand under rise of temperature.

It will be understood that on the explosion stroke, and when the connecting rod is at an angle to the piston, considerable pressure is imparted to the sleeves on one side, due to the lateral thrust of the piston. Consequently in the present case both the inlet and exhaust passages and the ports are arranged on the opposite side to that on which the thrust of the piston occurs during the firing stroke. In Fig. 1 the inlet passage is shown at A and the exhaust passage at B. It will be seen that the inlet gases are conducted upward to the sparking plug at the top of the cupped piston head by an inclined passage C. The inner cylindrical sleeve D in which the piston works is guided by the cylinder head as usual and reciprocated by a connecting rod and crank. It is also formed with inlet and exhaust ports at different levels. The outer sleeve (Fig. 2) is formed in two parts, *i. e.*, the part E which is fixed by means of the flange F and a movable part G provided with a lug H whereby it is operated by its connecting rod in the usual manner. The movable part has ports at J, the upper of which is the inlet port and the lower the exhaust port.

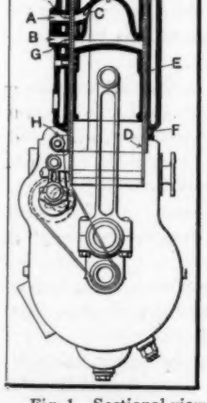


Fig. 1—Sectional view of the new Knight engine

The two sleeves operate in the manner usual in Knight engines, so as to bring the inlet ports in the two sleeves into line with the inlet passage AC during the inlet stroke and to bring the ports out of line for the compression and firing strokes. During the exhaust stroke the exhaust ports are brought into register with the exhaust passage B. By forming the outer sleeve in two parts EG, expansion is permitted as the parts heat up. It will be noticed that the movable part of this sleeve is arranged on the opposite side of the cylinder to that which is subjected to the lateral thrust of the piston.

It will be appreciated that in this form of construction a further advantage is present, *i. e.*, the reduction of the weight of the reciprocating parts forming the valve motion, the reciprocating portion G of the outlet sleeve being at most one-third the weight of the complete cylindrical pattern.

Laws Do Not Seem to Benefit Reciprocally

Editor THE AUTOMOBILE:

Looking over the interesting compilation of laws as they relate to the automobile in the various States of the Union, such as you published in your last issue, has given me more surprise than pleasure. For the careful reader of that article cannot but notice that most of these regulations are directed against the motor car, perhaps in deference to the non-automobilist's envy which the sight of the autoists might produce in his lowly heart; but quite a number of States sanction in their laws the most unscrupulous injustice toward the automobilist instead of justice to which he is entitled in the same measure as his pedestrian brother.

One misconception contained in the laws of several of the States is that they set forth an obligation on the part of the autoists to render the "operator" of domestic animals "any necessary assistance" in getting them to pass his car. Is it not enough that the motorist slows down his pace and gets out of the way of the unreasonable beast? Where is the great democratic principle of reciprocity? Suppose the fair lady in my automobile wears a red veil; a bull whose nerves and will power are thereby excited, smashes up my car; and, while the passengers, with the help of the Lord, might escape a more serious danger, I should like to see the farmer willing to make good for the natural peculiarities of the steer of which he is the owner; and if he is not responsible for the outrages of that amiable creature, why in the world am I?

Not only this, but another dozen of rules show only too clearly that they were dictated not by justice and common sense, but by municipal egotism and the interests of an undiscriminating few.

I wish to call attention to but one passage valid in so many States, viz., that the tourist charged with breaking the law is *entitled* to an immediate hearing; but in case such is *not given* to him—even though he is willing to get up against some venerable judge passing his days in the wilderness—he must leave a forfeit equal to the maximum fine which might be imposed upon him as a penalty for the offense with which he is charged. This sum may vary from $25 to $100; and while some citizens, especially in those portions of the land where everything abounds and a man's daily work consists in walking from his home to the post-office and back, with one or two stops at the Corner, will always be ready to show their heroism in stealing the time of an autoist by charging him with a crime he never committed, these automobilists are in most cases busy men who have neither time to spend a day or two in a town which would more fittingly be located in Greenland, nor do they feel inclined to throw hundred-dollar bills out of the tonneau. Needless to say, even should an automobilist await his trial and be acquitted, he will be given little if any satisfaction for his loss of time and temper.

There is said to exist some national organization having in view the interests of automobilists in this country. What has it ever done in this direction? I cannot understand why its efforts, if such were made, remain so utterly unsuccessful. Or can it be possible that nothing has been done to shield the comfort and the pocketbooks of half a million law-abiding American citizens? ONLOOKER.

Pittsburg, Pa.

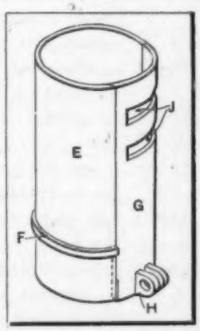


Fig. 2—Showing the outer sleeve of the new Knight engine and location of the ports for the control of the gas

When Judgment Whispers Don't

Epigrammatic Presentation of Things to Remember

Shop practice is a theme that gets more than its share of attention along old-fashioned lines, and not enough of study of the kind that is being favored among those who advocate scientific management of plants. It is believed that more work can be done by the men under classified conditions and that all concerned will be benefited if scientific lines are followed.

DON'T try to get the artisans to do more work for less pay.

DON'T reduce the quality of the work in a "rule-of-thumb" scramble to increase the output of the plant.

DON'T expect the men to keep awake if the ventilation of the plant is poor—even the owner of the plant will fall under the influence of bad air.

DON'T expect the men to do good work if they have to worry about their personal belongings—provide lockers for the apparel of the men.

DON'T try to save on the cost of heating the building in the Winter time.

DON'T run a sweat-box—men cannot think on a profit-sharing basis if they are getting the "third degree" at the same time.

DON'T use one time clock for a large number of men—they will have to stand in a row long enough to punch the clock when they are going home and they will recognize the imposition.

DON'T try to evade justice merely because you own or operate a plant; it is a high-priced practice.

DON'T fine men for making mistakes—you make a mistake by trying to transfer responsibility.

DON'T allow the workmen to take the responsibility for anything—the board of directors are justified in assuming that you are there to assume all of the responsibility.

DON'T let the artisans tell you how to do the work—tell them what you want.

DON'T try to make the artisans understand your language—tell them in their tongue what you desire that they shall do.

DON'T attempt to reform the men—they understand the language of drawings; pay for good drawings rather than for men to unravel the skein of unknown things that drawings too frequently depict.

DON'T allow draughtsmen to dream on paper and then send these dreams to the shop to have them reproduced in metal—the result will surprise you if you go so far.

DON'T assume that all of the cardinal virtues are to be had for the sum of $15 per week.

DON'T be content with men who go through "time-killing" motions; tell them how to conserve their energies.

DON'T accept the excuses of the executive members of the family—tell them that you want results.

DON'T wait until the first of January—there is no reason why the good work should not be going on all of the time.

DON'T turn your head away if someone comes along and tries to interest you in "motion studies"; the time is near at hand when it will be desirable for you to eliminate all useless motions.

DON'T expect the workmen in the shop to show you how much of their time can be saved by taking advantage of "motion studies."

DON'T advocate long hours; express a preference for big output.

DON'T express too much concern if the men get some of the benefit—"overhead" is the item that must be lowered.

DON'T overlook the fact that the "overhead" will be cut in half if your output is doubled in the same plant with the same force, provided the men do a little more than twice as much work as you now get out of them.

DON'T be satisfied with less than twice as much work as you are now getting out of your force—it is a possibility.

DON'T expect men to give you the result that you want if they are of the class who say "it can't be done!"

DON'T violate principles—accept abuses if you must!

DON'T allow abuses to go on forever—a good set of brakes will control them.

DON'T let any man stay in your plant a moment after he thinks that he is too insignificant to be known to you.

DON'T look upon a workman excepting in the light of an investment—express a preference for good investments.

DON'T be discouraged if the men seem to act on the suggestion that it is not a good idea for them to work harder than they do.

DON'T figure upon men working harder—show them how to deliver more product with less of the disagreeable effort that they desire to avoid.

DON'T try to gain the confidence of the men by some old "game"—what they want is a conservative investment.

DON'T encourage a "quitter"—replace him by a man of mettle.

DON'T be too quick to pounce upon the "under dog"—it may be the fellow "higher up" who is at the bottom of the trouble.

DON'T place as foreman over the men the type of man who has to tell the machinists to go ahead and do the best that they can—what you require as foremen are the class of men who know more about the work than the men can possibly get to the bottom of.

DON'T allow the machinists to feed themselves with work—push the work ahead so that they will have to feast their eyes upon it every time that they hesitate.

DON'T assume that workmen are gluttons—they may like good things for their stomachs, but their hands are less eager.

DON'T allow the machine tools to lag—speed them up according to some plan that you will have to contrive for the purpose.

DON'T have too many men at work in the plant—they will slow down to a "quartermaster's stroke"—fear of running out of work is a more forceful taskmaster than your persuasion.

DON'T hit ambition on the head every time that it bobs up—you cannot keep a good man down.

DON'T allow unusual energy in the guise of a "good workman" to go away from your plant.

DON'T mistake a loud mouth for a good workman.

DON'T keep books for the purpose of showing your losses or your meager gains—make records showing the progress of the work and predict the gains.

DON'T put up with the personal equation unless it is according to some well-thought-out system—the troubles of this character can be narrowed down by system.

DON'T pay engineers to specify materials and then allow the purchasing department to modify them—it is better to send the engineer away than to pay him to work and then pay someone else to kill that effort.

It Stands to Reason—

(Remembering That the Exception Proves the Rule)

THAT the best way to dispose of wares is to show them to a possible purchaser.

THAT it is not possible for a salesman to take a piano all around the country in order to be able to show it to those who deal in wares of this character.

THAT a piano can be taken from one town to another on an automobile and the salesman may then show it to each of his possible customers.

THAT enterprise makes a favorable impression—the salesman depends for his success upon this favorable impression.

THAT pianos are not the only wares that may be taken from town to town on automobiles.

THAT it is less expensive to take the goods to be shown on automobiles from town to town than it is to employ railroad trains.

THAT merchants are fast awakening to the greater possibility of the automobile as a means of transportation of the samples that the salesman takes along to attract the favorable notice of possible customers.

THAT salesmen should use freight automobiles that are made for slow speed, hard usage and continuous service.

THAT tires should be solid so that they will hold out for 20,000 miles of hard road work and conserve the time of the salesman in the work of taking samples of wares from town to town.

THAT the salesman should drive his own automobile—this means that it should be a simple and strong type of machine.

THAT a delivery wagon rated at 1,000 pounds for the net load would do the salesman in nine cases out of ten.

THAT it would not pay to invest in a car that is too light and work it on an overload basis all the time.

THAT the salesman should not get the impression that he is on a tour—give him an automobile of the class that will not deceive him.

THAT the automobile should travel on a fixed schedule—this means that the salesman should have his plans made for him before he starts out.

THAT there is no limit to the possibilities of the salesman with his own means of transportation.

THAT the merchandising of automobiles has not as yet started—it remains for the builders of automobiles to show wholesalers how they can do a good stroke of business using automobile transportation for the drummers who swarm over the country in quest of trade for their houses.

THAT it is not to be expected that the agents for the makers of automobiles will tap this almost virgin field—it is a makers' problem to solve.

THAT advances are being made in several important directions in the automobile business, but there is need of system, and the training up of men who will find the true reason for everything they do.

THAT there are too many dull axes being ground at the expense of production, and maudlin sympathy is having too much to say about the things that are being done.

THAT it is not always possible to get better work out of your relative than it is out of some fellow who has to deliver quality to keep his job.

THAT quality is a white ball in the tally-box every time.

THAT a good man can turn out quality work at a lower cost than will be shown by the expense account for the other kind.

THAT paper dividends are the ingenious devices of men who are trying to hide their light under a bushel—the light shines for the receiver.

THAT real dividends cannot be counted with certainty unless the work is done by men of skill under the immediate direction of men of accentuated skill.

THAT men of broad experience proceed along classified lines telling the men who work for them what to do, and when to finish.

THAT it is of no avail to tell a man what to do, and when to start in.

THAT some men have the unfortunate faculty of starting a great many things—they never finish anything.

THAT the building of automobiles gets beyond the direct line of vision of the responsible head, and wisdom says, "The eye of a good system must see the rest."

THAT every workman thinks he knows more about his specialty than the man for whom he works.

THAT a good workman can do a large amount of damage thinking for himself instead of obeying orders.

THAT the workman cannot obey orders unless they come to him dressed in the garb that will attract his discriminating notice.

THAT too many things are left entirely to chance—the workman is often expected to anticipate the wants of the employer.

THAT the average workman anticipates pay-day and quitting time if things are left to his imagination.

THAT many economies that would in nowise interfere with the quality of the product might easily be effected in plants wherein the management labors under the delusion that everything is going along all right.

How to Get Business

Illustrating the manner in which foreign automobile makers make concessions to prospective customers in order to insure their patronage, and how American makers, by insisting on a too close adherence to the business methods in vogue here, frequently lose out.

HERE is an instance of the contrast between certain American and British manufacturers who set out to get some of the West Indies trade. Quite a number of American as well as British manufacturers received invitations from planters in Jamaica to send motor cars to the island on trial. To the request one American maker of cars replied that any tests insisted upon must be made in the United States; and that the car must be paid for before shipment. But the British manufacturer agreed to ship a 40-horsepower, 4-ton capacity freight automobile (equal to 250 bunches of bananas) to Jamaica on the payment of 1 pound sterling ($4.86), and freight. He further said that he would pay the return freight and refund the planter's 1 pound sterling, in the event that the car failed to make good in the test. The car came down in a hurry. But as if this was not enough to show the manufacturer's good will, he shipped an extra set of solid tires and a liberal supply of repair parts. And to go himself one better, he sent along an expert mechanician whose wages he contracted to pay for six months. At last accounts the car was fulfilling its obligations satisfactorily in every respect.

In the Carbonizing of Steel

Fixing the Practical Limitations of Carbonizing Process

E. F. Lake presents photo-micrographs of carbon steel under varying conditions in the carbonizing process, and discusses the details of this undertaking in a plain and substantial way for the edification of the man in the hardening room, rather with the expectation that he will be afforded a clear insight into the limitations governing this type of undertaking, aiding him in devious ways for his own benefit and the good of the industry.

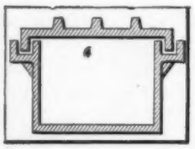


Fig. 1—Section of a hardening box, showing a cover that can be looted to tightness

IN manufacturing some parts of the automobile, carbonizing is resorted to in order to get a hard outer surface and a tough center. Gears, cams, ball races, etc., have been heat-treated in this way almost from the start of the automobile industry and there is yet to be found a better method of producing the clash gears used in the transmission case.

Many attempts have been made to manufacture a steel that would give as good results when hardened in the ordinary way, as do gears that are carbonized, but no such steel has yet been produced. The latest attempt along this line was the silico-manganese steels that were exploited for a few years and used by two of the leading motor car builders in this country. The silico-manganese steel, however, did not prove as good as the high-grade steels that were carbonized and consequently its use was abandoned.

By the carbonizing process gears are manufactured from which it is almost impossible to break the teeth by any kind of a clash. The best metal for this purpose is a low carbon nickel-chrome steel.

Of the carbonizing processes, there are two. The old method consists of packing the parts in bone and charcoal in an iron box, similar to that shown in Fig. 1, and heating it in a furnace for a number of hours. The other method is that perfected by the American Gas Furnace Co., in which a special furnace uses carbon monoxide gas for the carbonizing material. The steel parts are placed in a revolving retort and a hinged cover fastened over the end. This retort is surrounded with the heating gas while it revolves. In one end is injected the carbon monoxide gas, while at the opposite end is a vent to permit the gas to escape from which the carbon has been extracted. Practically the same results are obtained with both of these methods, but the machine that carbonizes with gas saves the time consumed by packing the iron boxes and then sealing them with fire clay.

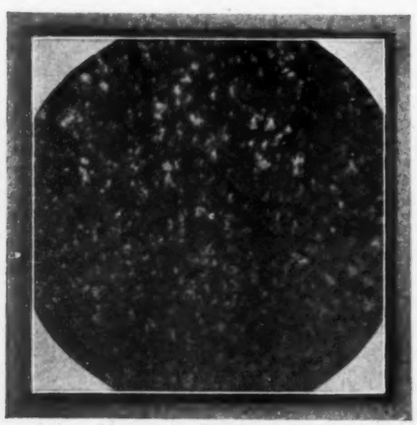


Fig. 2.—Core of steel that was not properly hardened as it looks at 300 diameters under the microscope

In the older method many different materials that might increase the speed or depth of penetration or increase the amount of carbon absorbed by the steel, have been experimental with. Nothing has been found, however, that is better than charcoal and bone. The burnt bone can form the charcoal. This has been called charred bone, charcoal, burnt bone, unwashed animal black, animal charcoal, etc., by the different experimenters. The new bone has been called ground bone, carbonate of barium, etc. These are mixed in the proportions of 60 per cent. burnt bone to 40 per cent. of fresh bone, that is when the carbonized pieces are removed from the burnt bone 40 per cent. of fresh bone should be added to the mixture before using it to pack other parts in.

Notwithstanding the facts that many special, secret and patented compounds are on the market to carbonize with, and many hardeners and shops have their special preparations and secret formulas, for carbonizing steel, none of these will give any better results than the bone and charcoal. Many of them will not give as good results; either in the speed of penetration, the percentage of carbon, or the quality of the metal after it has been carbonized.

Of the various elements in steel, the carbon penetration is affected by manganese, tungsten, chromium, molybdenum, titanium, nickel, silicon and aluminum in the order named; it being the highest with manganese and lowest with aluminum. When silicon is very high the speed of penetration is greatly reduced and with a 5 per cent. silicon content the steel will not absorb any carbon. Manganese, tungsten, chromium and molybdenum increase the speed of penetration as the percentage of each is increased; but with titanium, nickel, silicon and aluminum the percentage decreases with each increase in percentage. Titanium, however, is now used in such very small percentages that it has practically no effect on the carbon penetration.

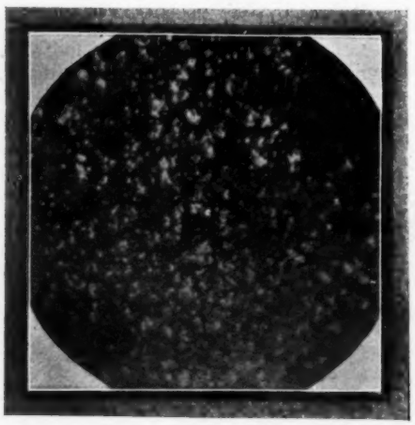


Fig. 3.—Shell of steel that was not properly hardened as it looks at 300 diameters under the microscope

The old method of heating the packed carbonizing boxes was to build a brick oven that contained a platform on which to place the boxes and a grate underneath it, on which to build a fire with coal. Even though this method is the oldest, most expensive and most uncertain, we see some firms still building carbonizing furnaces in that way. With nearly all carbonizing steels, it is necessary to maintain the temperature at 1,650 degrees F. for the number of hours that is required for the given depth of penetration.

With this coal fire, if the door is open to rake the fire or add fuel, the temperature is lowered several hundred degrees. When the fire door is closed considerable time is consumed in getting the furnace back to the carbonizing temperature. This makes the

temperature of the furnace very erratic and it is very difficult to get the same results with any two batches that have been carbonized. In addition to this, the total cost of a coal fire is about 1-3 more than city gas and more than double that of natural gas or crude oil. With these built-up brick furnaces, gas and crude oil have been used for the fuel, but this method is much more expensive than sheet metal furnaces, lined with fire brick, owing to the large loss of heat by radiation that is encountered in the old style brick furnace. In any style of furnace, the products of combustion should not be allowed to come in contact with the steel being carbonized.

The hardening after carbonizing is of vital importance, if the outer carbonized shell is to give its best wearing qualities and strength, while the inner core gives its greatest toughness. In Figs. 2 and 3 are shown microphotographs of the core and carbonized shell of a fine grain steel that was improperly heat treated; while Figs. 4 and 5 show the same steel correctly heat treated. The fine silky grain of Fig. 5 would have the appearance of that shown in Fig. 3 if the grain had been coarsened from over-heating. Fig. 6 shows fissures between the core and outer shell of a carbonized steel that was caused by incorrect heat treating.

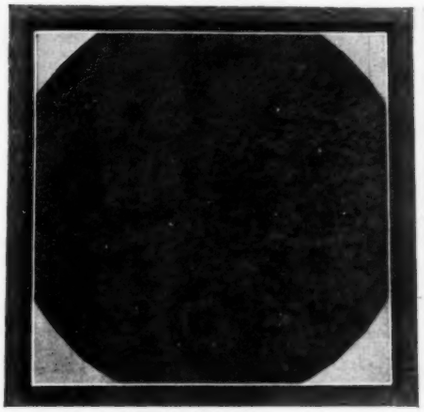


Fig. 4.—Core of a properly hardened piece of steel as it looks at 300 diameters under the microscope

Carbonized steels should always be annealed after carbonizing in order to remove any internal strains that may have been set up. This can easily be done by putting the box where it will cool off slowly after it has been removed from the carbonizing furnace, or the boxes could be left in the furnace and the furnace cooled off slowly. If the carbonizing temperature has not been over 1,650 degrees F., the pieces can be allowed to cool to 750 degrees and then reheated to 1,400 degrees and quenched with very good results. If a high carbonizing temperature, *i. e.*, one around 1,800 degrees F., has been used, the work should be cooled slowly, then reheated to 1,650 degrees and quenched, and reheated again to 1,400 degrees and quenched. This double quenching is required to destroy the crystallization that may have been caused by over-heating and thus refine the grain. The first heating gives the core its proper heat-treatment but leaves the outer surface in a poor condition to resist wear. The second heating gives the carbonized shell its proper wear-resisting properties.

The point of transformation varies with the different alloyed steels on account of their different ingredients, and thus the actual degrees given above cannot be strictly adhered to. It is first necessary to find the highest recalescent point in the grade of steel being heat-treated and then heat it to this temperaure.

In conclusion, I might reiterate that there are no secret or patented compounds for carbonizing steel that are any better than bone and charcoal, or the carbon monoxide gas of the gas process; also that the modern furnaces using gas or fuel oil are far ahead of the older coal-fired furnace, either for the quality of the product carbonized in them, or the speed with which steel is carbonized and for the economy of fuel.

Difference Between Thinking and Acting

AUTOMOBILISTS complain that inactivity is at the bottom of more than half of all the trouble experienced. The great main question is that most of the complainers do too much thinking, leaving but little time for them to utilize in action. In the same way, the man who thinks that there is an accumulation of carbon in the cylinders of his motor promptly goes after chemicals and puts them into the cylinders, with never a thought as to the consequences. Plainly, it is obtuse to thus act; if the cylinders are not in need of attention, what is the sense in thus using chemicals? Then, there is the probability that the carbon eater that is put in the cylinders may not be content to eat the free carbon that is lounging around over the surfaces and the question arises: What if the "eater," failing to appease its hunger on the free carbon, were to go at the carbon of which good cylinder castings have a quota? In the matter of acting it would seem to be a good idea to first determine the condition of the cylinders and then try some plan for the purpose of fixing the trouble. It is the same way in quite a number of the undertakings; they must be investigated; the remedy is to follow!

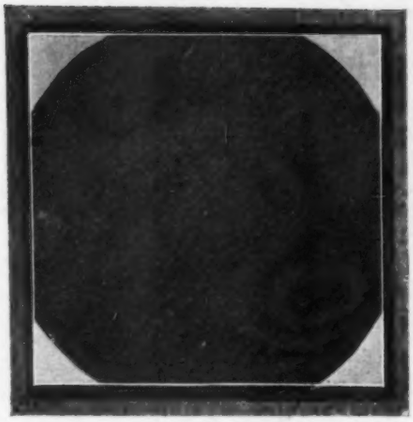


Fig. 5.—Shell of a properly hardened piece of steel as it looks at 300 diameters under the microscope

Touring in Jamaica

With some of the best roads in the world, and a climate that is delightful, the conditions that obtain on the island are such that automobilists seeking new experiences will find much to interest and amuse them there.

THERE is a mighty treat awaiting the traveler who has yet to include Jamaica in his itinerary. Starting from Montego Bay, one may wind along, passing through Spanish Town, which was the ancient capital; Kingston, the present capital; and brings up in Port Antonio. In fact, Kingston is regarded by many as the right sort of headquarters from which to make automobile trips. The streets of this quaint old town are as smooth as a floor and well-built. It is not necessary that the tourist or the party of tourists should own their automobile. There are local concerns on the island who supply not only fine cars, but chauffeurs who are fully competent and reliable. Nor should the would-be automobilist forget that the roads of Jamaica are among the best in the world. This is due to the vigilance and efficiency of the Government, under whose auspices upward of 2,000 miles of macadamized thoroughfares are kept up. There are also 4,000 miles of splendid roads on the island which are built and cared for by the several parishes. In addition, the weather, except in the rainy season, is all that can be desired.

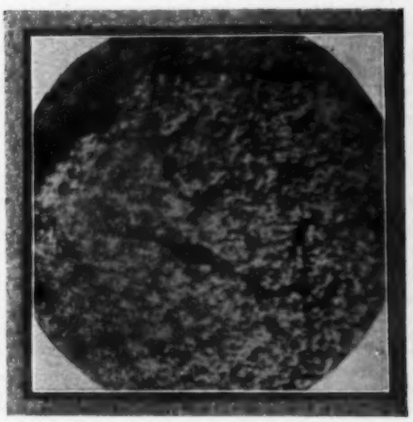


Fig 6.—Fissure in the section between core and shell, which is the result of an improperly conducted hardening process, seen at 300 diameters under the microscope.

Diagrams and How to Read Them

Describing Seriatim the Phases of the Cycles

IN a previous article it has been shown what can be learned from the examination of the *characteristic curves* of an internal combustion motor.

This is not the only interesting curve as there are others that permit one to obtain more precise information on the running conditions of the motor. These curves are the diagrams of the cycles or just simply diagrams.

WHAT IS A DIAGRAM?—Consider two straight lines at right angles *ox* and *op* and suppose that they represent at every part of the cycle of the motor the state of the gaseous mass contained in the cylinder. For this purpose mark off on *ox* lengths proportional to the displacement of the piston starting at the bottom of the cylinder. Let *m* equal the point thus obtained. At the time that the piston is at the point corresponding to *m* it is necessary to measure the pressure of the gaseous mass which is acting upon it. Let P equal the value of this pressure.

Through the point *m* draw a perpendicular line on *ox* with a length equivalent to the pressure P and the point M will be obtained which will be equal to the state of the cycle at the considered moment. During the displacement of the piston the pressure varies; the point M will describe a certain curve and the curve thus described will be known as the *diagram* of the cycle. In a four-cycle motor it will have a theoretical form similar to the one shown in Fig. 1.

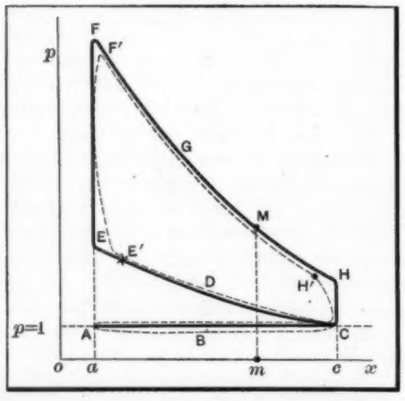


Fig. 1—Theoretical diagram of a four cycle motor

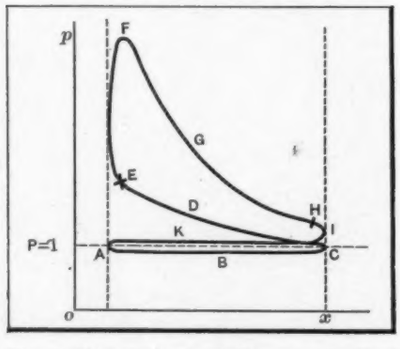


Fig 2—Normal form of diagram. A, B, C, suction; C, D, E, compression; E, firing; E, F, explosion; F, G, H, expansion; H, opening of the exhaust valve; H, I, K, A, exhaust.

The suction is produced during the travel of the piston from *a* to *c*. The pressure inside the cylinder remains the same as the atmospheric pressure. The representative point will describe the straight line A C parallel to *ox*. During the compression the pressure increases and if one presumes that the phenomenon takes place sufficiently fast so that there is no loss of heat between the gas and the cylinder walls the point describes the adiabatic line C D E. "An adiabatic curve is a curve exhibiting the variations of pressure and volume of a fluid when it expands without either receiving or giving out heat."—Rankine.

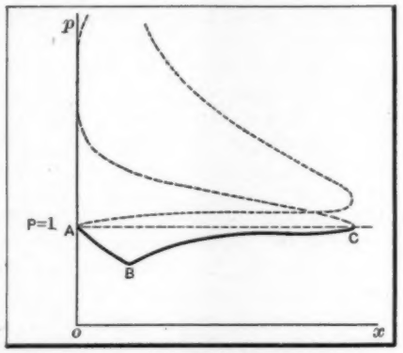


Fig. 3—Effect produced by the late opening of the intake valve: The pressure drops rapidly from A to B

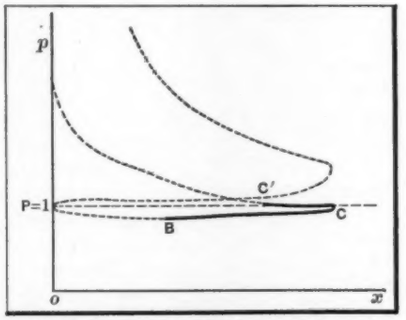


Fig. 4—Effect produced by late closing of intake valve. Pressure remains same as atmospheric from C to C^1 and compression does not really begin before C^1

Ignition takes place at the point E and the pressure immediately increases rising to the point F. The expansion starts at F and under the same hypotheses as before the curve will be an adiabatic one similar to F G H. The exhaust valve opens at the bottom of the stroke and the pressure drops abruptly H C. It then remains equal to atmospheric during the return stroke of the piston C A. As a matter of fact the cycle of a motor differs quite considerably from the theoretical one just illustrated. In the first place in order that there should be suction it is necessary that there should be a depression in the cylinder. Therefore the induction curve will be below the theoretical line A C. During the compression the cylinder walls give off a small quantity of heat which raises the pressure somewhat, which is not shown in the theoretical curve; the pressure curve will be therefore for the greater part above the adiabatic C D E. On the other hand the inflammation of the gas is not instantaneous, which necessitates firing the charge before the dead center, which means that the straight angle is altered into a curve E' F'. During the expansion the gas gives off a certain amount of heat to the walls; the expansion curve will fall below the adiabatic F H. Finally in order to avoid a large degree of counter pressure during the exhaust, the exhaust valve is opened before the piston has arrived at the bottom of the stroke at H' for example and during the return stroke the curve runs just above the straight line C A. This is known as a manograph diagram of a motor.

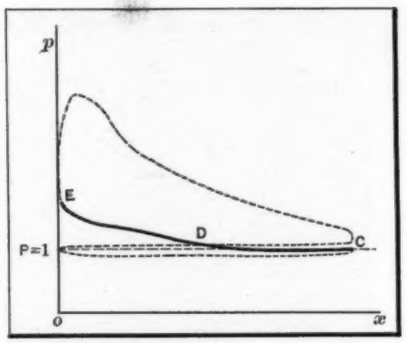


Fig. 5—Loss of compression due to a leak

But one of its branches will have a pronounced abnormal shape and it is just this that will permit one to see wherein the motor is not working properly.

Any Abnormal Functioning of the Motor Has an Immediate Repercussion of the Form of the Diagram, Which is Immediately Modified in Its Entire Form.

INDUCTION.—When the curve A B C (Fig. 2) falls throughout its entire length considerably below the line P = 1 without showing any angularities or inflexions one can presume that the motor is being badly nourished, probably due to the insufficient lift of the intake valves or their having too small a diameter. The induction curve could present the form indicated in Fig. 3. That would show that the induction valve opened too late; the depression in the cylinder has attained a large proportion (the part A B of the curve) before the gases have found an entrance into the cylinder.

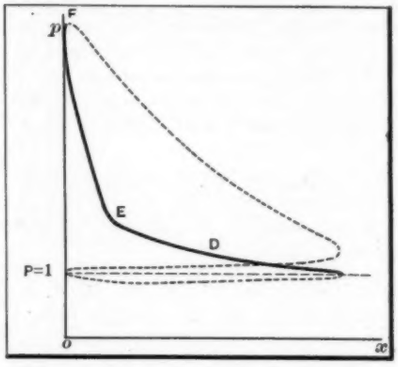


Fig. 6—Too much advance to the ignition

In examining Fig. 4 it will be seen that the start of the compression curve C C' runs along the straight line P = 1 on account of the late opening of the intake valve. These two faults are usually shown on the same diagram. They point to bad setting of the timing gears, the cam shaft pinion on the induction side being out of its normal position in relation to the motor pinion (one or two teeth out). This is translated into a lowering in the explosion pressure and consequently a falling off in power.

COMPRESSION.—It may happen as shown in Fig. 5 that the compression curve C D E is too close to the straight line P = 1, which means that the amount of compression is greatly reduced. If the suction curve is normal this form of diagram shows a leakage in the cylinder. The seating of the valve should be looked over, also the seating of the valve plugs and the piston rings as well.

But if at the same time the induction curve is very low, indicating a considerable depression in the cylinder, it will be found that the cause is due to the before-mentioned reason: insufficient opening of the intake valves.

IGNITION.—Ignition errors have the greatest influence on the general form of the diagrams as can be seen by examining the diagrams shown in Figs. 6 and 7. Fig. 6 shows the effect of an exaggerated amount of advance of the ignition. The portion of the curve E F corresponding to the variation of the pressure due to the inflammation of the gas, instead of being practically vertical as in the diagram in Fig. 2, is very much inclined. The useful surface of the diagram is reduced as well as the power. Furthermore the increased strains to which the different parts of the motor are subjected, such as the connecting rods, wrist pins and crankshaft, have a disastrous effect on upkeep.

The effect of late firing is seen in the diagram in Fig. 7. The ignition does not take place till the point E has been reached, after the piston had passed over the dead center. The final pressure is lowered and the diagram presents a very characteristic form.

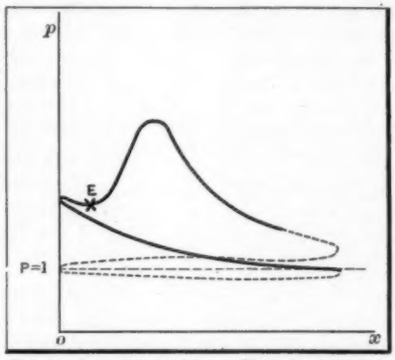


Fig. 7—Retarded ignition. The piston starts on the downward travel before the mixture has been fired

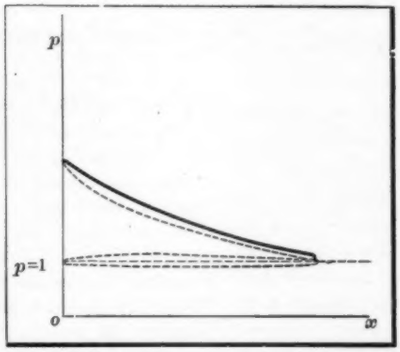


Fig.—8—Effect of a misfire. The expansion curve is practically lost in the compression curve

The spark may not take place at the right moment, in which case the manograph will indicate a retard effect. The phenomenon can also be accounted for by the bad position of a spark plug whose points are stored away in some lone cavity inacessible to the cylinder. If on the other hand the ignition retard is irregular it points to bad carburetion. It is well known that the mixture of air and gasoline vapor will not ignite rapidly unless it is composed of a slight excess of the amount of air required for combustion. In that case it is better to study a series of diagrams rather than an isolated example.

It is quite probable that one will find several curves on the series that present a form similar to that shown in Fig. 8. The spark did not take place and the curve of the expansion will become confounded with the compression curve.

EXHAUST.—If the expansion curve as shown in Fig. 9 runs into the adiabatic theoretical curve up to the point I instead of falling off at the point H as in Fig. 2 it shows that the exhaust valve opens too late. The first part of the exhaust curve I K therefore is much above the line P =1 denoting a counter pressure behind the piston. Fig. 10 shows the counterpart of the preceding one in which the exhaust takes place too early.

These two forms of diagrams indicate a disarrangement of the timing gears usually due to bad assemblage of the camshafts.

In this study there is one practical conclusion to be drawn and that is that every works and even repairshop should be equipped with a good manograph. It is not necessary for each individual to be possessed of such an instrument as the price is somewhat high and the use he could obtain from it would be very limited.

KEEP OUT OF THE REPAIR SHOP—It is a great mistake to court a trip to the repair-shop. This idea is present when the automobilist drives along the road at a high speed.

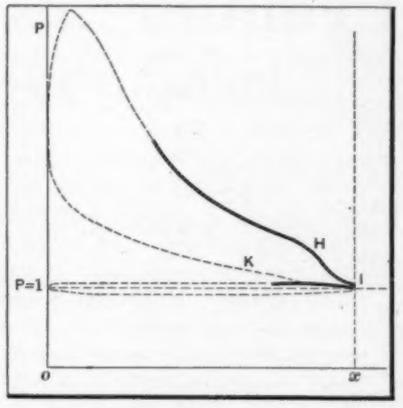


Fig. 9—Exhaust opening too late. There is notable counter-pressure during first part of scavenging

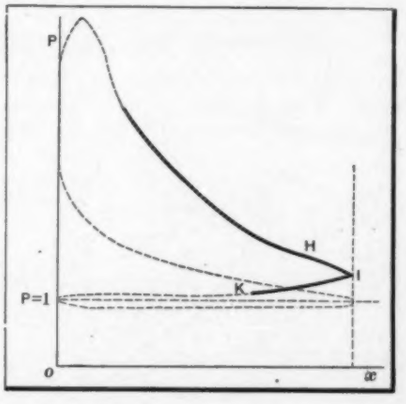


Fig. 10—Exhaust valve opening too early. Curve will be seen to fall off before piston reaches end of stroke

Motor Stage in Guadeloupe

Land transportation in this French West Indian island is practically restricted to the motor, and the home government is rapidly extending the service by granting concessions wherever the traffic warrants it.

FROM Pointe à Pitre to St. Francois, Guadeloupe, in the West Indies, is 27 miles; and from Pointe á Pitre to Basse Terre is 41 miles. A daily passenger and mail service has just been provided for between these points by the Colonial Government of Guadeloupe. The contracts have been let for equipping the respective lines.

In the case of the Pointe à Pitre to St. François line, there is a specific stipulation relative to the model of the automobiles that are to be used. There are to be three machines each with a capacity for seating eight persons. The sum of 25,000 francs ($4,825) is to be paid to the concessionaire annually as a subsidy, the contract having a life of nine years to run.

No hard-and-fast rule applies to the type of automobiles which are to be used over the Pointe à Pitre to Basse Terre route. This route has served as a bone of contention for a number of years, and from the beginning a sort of unwritten law was laid down that when the time came, the equipment of the line should embrace 16-horsepower, steel-tired steamers made in France. Just now eight motor cars of this type are being purchased by the Colonial Government. The capacity is to be six passengers and one-half ton of luggage. For the first year at least, the Government will regard these automobiles as being in the experimental stage. The sum of 30,000 francs ($5,790) is to be the annual subsidy allowed the concessionaire.

The Trend of Events

POINTS to a better understanding of the relation of roads to automobiles—it is possible to foresee the day when good automobiles will be conserved by equally well-made roads.

POINTS to the use of properly treated steel, but this will not be the ground for laying the foundation of the structure of initially inferior steel.

POINTS to the employment of body-work that will co-relate to the chassis design and construction more closely than the indications are of the work of those who prolonged the carriage-makers' art.

POINTS to the use of leather in the upholstery that will not "crock" and soil the frocks of the ladies who recline on the cushions and rest against the backs of the seats.

POINTS to a better understanding of the tire problem, and to the fact that there is a well-balanced relation between diameter and section of tires.

POINTS to the annealing of steel castings before placing them in service; this process is responsible for the birth of a finer grade and a better measure of reliability of the steel under rigorous service conditions.

Premier Builds "4-40" and "6-60"

Plans as Previously Formulated Worked Up

Having proceeded originally along broad engineering lines, eliminating compromising measures, and building wisely, it appears that Premier automobiles for the next year will conform to the original idea, and the plant will be devoted to the manufacture of the four-cylinder 40-horsepower motor and the six-cylinder 60-horsepower model, subject to the refinements that experience indicated, of which, however, there are but few to report.

STRIKING in similarity of general engineering design, the 4-40 and the 6-60 models of the Premier Motor Mfg. Co., of Indianapolis, Ind., may be laid alongside of each other for comparison, when it will be seen that the 4-40 model has a four-cylinder water-cooled motor, with the cylinders cast in pairs, and the bore of the cylinders 4 1-2 inches, with a stroke of 5 1-4 inches. The six-cylinder motor is of the same general design, with similar bores and strokes, the difference being in the length of the crankcase, details of construction of the crank and camshafts, and the use of three pairs of cylinders

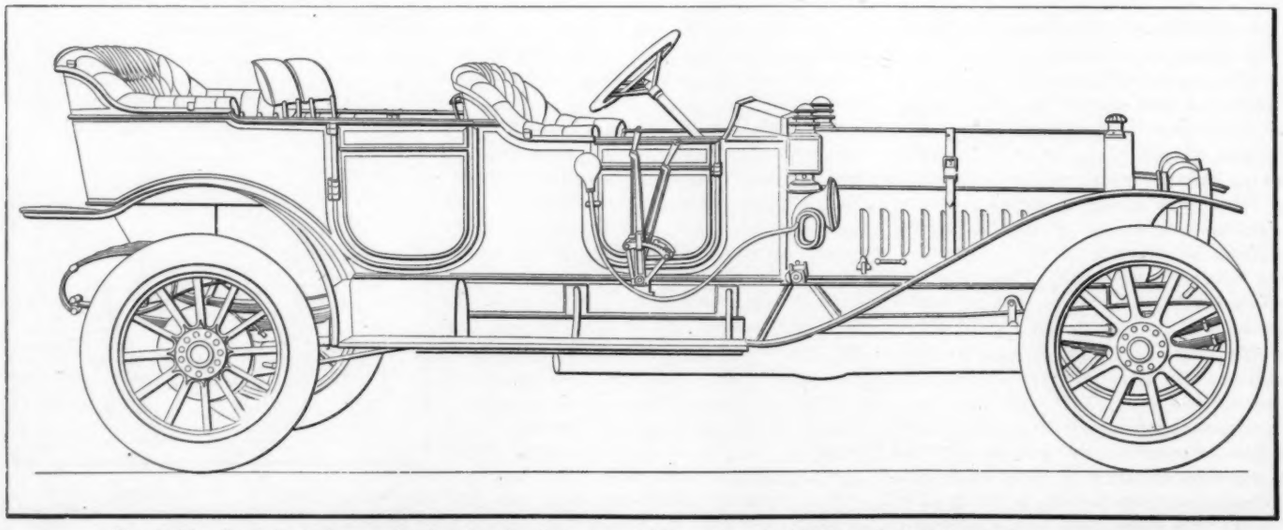


Fig. 1—Premier 6-60 touring car fitted with a foredoor type of body with a straight-line effect, with seats for seven passengers

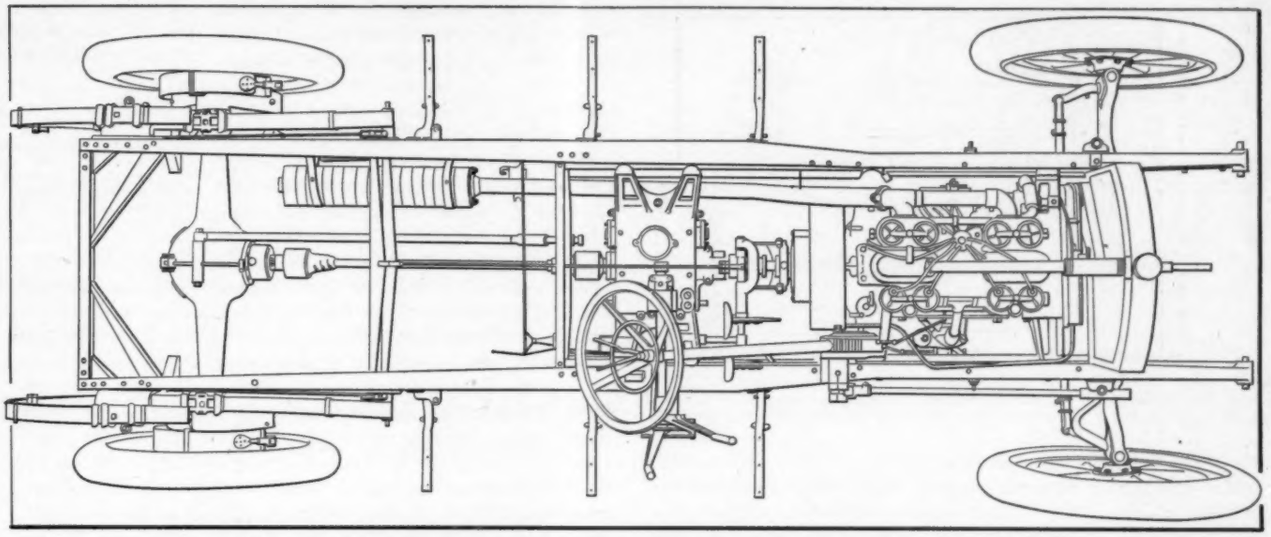


Fig. 2—4-40 chassis shown in plan giving the location of the transmission gear as a unit amidship

instead of two pairs of cylinders as on the four-cylinder motor. The six-cylinder motor being longer affects the general appearance of the car complete, to the extent of lengthening the bonnet, as shown in Fig. 1.

With the four-cylinder motor in the chassis, the plan of the same is given in Fig. 2, indicating a three-speed selective type of transmission gear as a separate unit placed amidship, this being common practice in Premier cars. Confining the discussion for the time to the chassis, attention is called to the stout side bars with reinforced front ends, terminating in wide flanging, beginning at the narrowing adjacent to the flywheel and extending back with a gradual taper, terminating at the rear crossbar. The muffler is placed at the left-hand side between the transmission gear and the live rear axle, and the exhaust pipe affords a free passage for the burnt products, saving the motor from back pressure. The chassis is suspended on three-quarter elliptic springs at the rear, using wide plates and a sufficiency of metal to limit the fiber strain to a degree that justifies the expectation for long life and freedom from spring failures under the conditions of high speed and rough going.

The scheme of design of the six-cylinder crankshaft is shown in Fig. 3 in which one of the connecting rods is assembled with the piston in place, and another of the connecting rods is attached to the crankshaft with the piston removed, showing the piston pin fixed in the rod end, it being the practice in Premier work to place the piston pin bearings in the form of bushings in the bosses of the piston.

The six-cylinder motor, looking at the left-hand side, is shown in Fig. 4, with the magneto resting on a ledge on the crankcase, taking its drive from the half-time gear housing in front, with a universal joint in the length of the driving shaft, thus affording immunity from the ills of poor reassembling, if, in the course of time, a repairman is called upon and he has occasion to take the motor down, necessitating the removal of the magneto and its ultimate replacement. Fig. 5 shows the right-hand side of the motor with a Stromberg carbureter in the mid-position, and the intake manifold leading up and branching out to connections between the pairs of cylinders from where the gas passes through the transfer ports in the twin cylinder castings, controlled by the valves to the combustion chambers.

Multiple-Disc Clutch Made Up of Substantial Plates with Cork Inserts

Fig. 6 shows the multiple-disc clutch disassembled with the discs D1 nested in the housing F1 and one of the discs, G1, separated showing the cork inserts at equidistant points over the face of the disc. The clutch shaft S1 has a square end engaging a broached hole to match, and the slip joint U1 is in a fluted relation with the shaft. Fig. 7 shows the general assembly of the motor clutch, transmission gear, pedals, side levers and the relating members. In this view it will be seen how the exhaust manifold passes down from the cylinders skirting the top side of the flywheel, and passing to a point below the sidebar and back to the rear through the muffler. This view also shows the perfectly straight brakerods and the symmetry of design in point of detail of the mechanisms throughout. Referring to Fig. 8 of the motor, looking into the crankcase, the pan being removed for the purpose, the bearings M1, M2, M3 and M4 are self-contained, with retaining caps that are bolted to the upper half, thus limiting the work of the pan to the effort of holding lubricating oil and warding off foreign matter.

Referring to Fig. 9 of the transmission gear, attention is called to the relatively short prime and lay shafts, they being or large diameter, and the gears thereon are of symmetrical design, wide face, and have other characteristics that denote stability. The sliding gears are provided with broached holes, engaging a square shaft. Both shafts float on annular type ball bearings, and the stub-end shaft beyond the jaws of the direct drive floats on two relatively large annular type ball bearings, they being spaced far enough apart to support the combined effort.

From the transmission gear to the live rear axle, as shown in Fig. 10, a relatively long propeller shaft with two universal joints is used. Referring to the live rear axle, it is of drawn steel of the tapered-tube type with an enlargement at the middle to accommodate the bevel drive and differential gearset. It is a noteworthy fact that the bevel pinion is supported on both sides by annular type ball bearings, thus doing away with any overhang, and making it possible to fix the relations of the mating bevel gears, so that noise or the ills of too much "shake" are done away with. Fig. 11 shows the enlargement of the live rear axle, the relation of the rear universal joint and the torsion member.

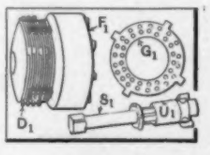


Fig. 6—Multiple-disc clutch made up of steel on bronze with cork inserts

Referring to the front axle, as shown in Fig. 12, it is of the I-section with an Elliott type of knuckle K1, with an enlargement to support the steering arm, A1, which is held in place by a lock-nut, L1, and the connections of the cross and dragrod, one of which is shown at Y1, are of the yoke type with large bearings and hardened members, the idea being to defeat lost motion in the steering equipment. Fig. 13 shows the worm and gear of the steering system, and

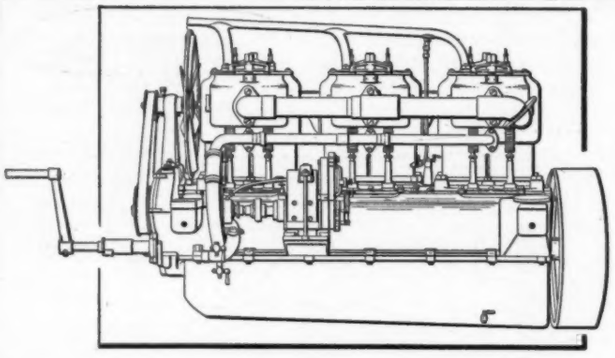


Fig. 4—Left-hand side of the 6-60 motor, showing the magneto and water pump driven by a common shaft from a gear in the half-time housing

Fig. 14 presents a large-diameter steering wheel with a stout spider sufficiently dished to accept responsibility without fear of consequences.

Main Data of the 6-60 Model

Remembering the size of the motor, as previously stated, and the use of a centrifugal water pump in conjunction with a cellular type of radiator, it is a condition of the installation of these equipments that the piping of copper holds excellence of the coppersmith's art and freedom from troublesome leakage is promised thereby. In the installation of the carbureter, remembering how difficult it is to distribute mixture to six cylinders, under mediocre conditions, an effort is made in this example to obviate the difficulties involved, and remembering, too, that the manifold is an essential part of the mixing equipment, it has been stopped off on the faces of the cylinders, adjacent to transfer ports, they being so designed that the water-jacketing is a means for delivering heat to the incoming mixture, thus saving the liquid in the fuel from getting into the combustion chambers of the motor, where it would crack and produce carbon in the absence of these preparations.

The high-tension Bosch system of ignition on the exhaust side of the motor bespeaks attention to the serious problem of keeping a fire wall between the gasoline and the ignition source. The ignition magneto is supported by an auxiliary ignition system, with a storage battery as the source of the electric charge. In the lubrication system, while a controlled "splash" is taken advantage of, the circulation is, nevertheless, positive through a gear pump, fixing the oil level with means whereby the oil may be replenished as it is burned up, but the supply is so carefully regulated that excesses of lubricating oil do not get into the combustion chamber and smoking of the motor is prevented.

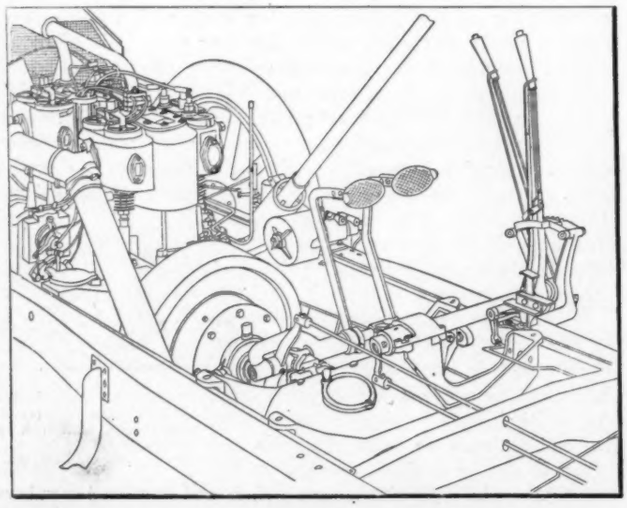


Fig. 7—Assembly of the machinery unit showing the relations of the members

The live rear axle with its stout construction is of the semi-floating type, and the ratio of the bevel gear is 3 to 1. The service brakes are of the expanding type, the drums on the rear wheels, with the emergency brakes acting on the same drums, they being of the constricting type. The facings of the service brakes are bronzed with cork inserts, and the facings of the emergency brakes are camel-hair. The area of the braking surfaces is a little under 600 square inches, and the control of the service brakes is by a foot pedal, the emergency brakes being controlled by a hand lever at the right side.

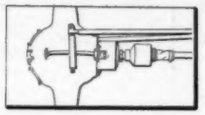


Fig. 11—Enlargement of the live rear axle showing a universal joint at the extremity of the propeller shaft

Referring to the wheels, which are of hickory and well designed, they are fitted with Q.D. rims for 36-inch tires, with a 5-inch section at the rear and a 4 1-2-inch section at the front. The wheelbase is 140 inches, with a tread of 56 1-2 inches, and the weight of the chassis complete is 3,030 pounds.

Main Data of the 4-40 Chassis

There are no striking differences in the general curves of the 4-40 as compared with the 6-60 motor. The rear axle equipment differs only in that the gear ratio is 3 1-2 to 1 instead of 3 to 1, and identical conditions obtain in the details of the brakes. The front and rear springs are identical. The front axle offers no difference for comparison. The chassis frame is from the same moulds. The wheels are substantially the same, excepting that the tire equipment with 36-inch diameter tires has a 4 1-2-inch section for the rear as well as the front wheels. The 4-40 model, considering the stripped chassis, weighs 2,810 pounds. The wheelbase of this model is 126 inches, the tread being 56 1-2 inches. The gasoline tank in both models holds 20 gallons of liquid.

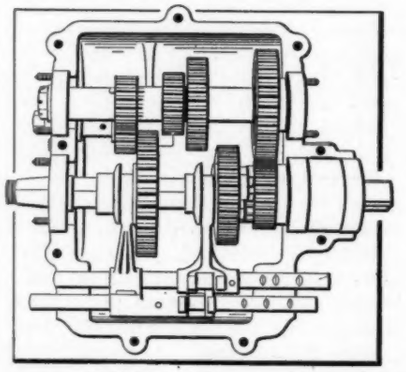


Fig. 9—Looking into the transmission gearset showing stout shafts rolling on annular type ball bearings

Other Features of Note Common to Premier Construction

Annular types of ball bearings are used in the rear axle bearings including the road wheels, also supporting the differential set and on both sides of the bevel pinion of the bevel drive, and in the mounting of the ball bearings closures are provided at every point, thus retaining the lubricant in the bearings and excluding foreign matter of the kind that kills. Under the general plan, as the cars are produced in the Premier plant, a system of jigs and special tools are employed whereby interchangeability is established and repair parts, if they are shipped from the works to a distant point, will fit in substitution for the parts that are worn out in service. This idea of interchangeability extends to every point including the grinding of cylinders and of valves, and provision is made for the accommodation of the varying length required of the valve stem as

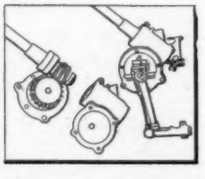


Fig. 13—Worm and gear of the steering system showing the housing and the assembly of the set

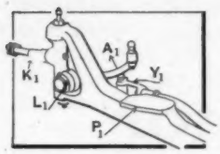


Fig. 12—Front axle end of the I-section with an Elliott type of knuckle

the result of grinding-in during operation, so that the timing of the motor may be adjusted from time to time according to the necessities in service.

In the repair shop, if it is necessary to disassemble a car, provision has been made for the taking down of the units without interfering with the remaining units, and in this way the cost of operation during a term of years is minimized. The scheme of design does not include a multiplicity of adjustments, it being the idea that a man of little skill cannot obtain the best results if he is given license to adjust parts to accord with the dictates of his unskilled ear.

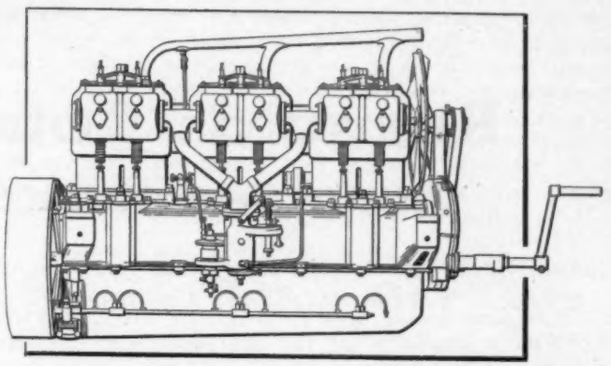


Fig. 5—Right-hand side of the 6-60 motor, showing the Stromberg carbureter in the mid position with a special form of manifold leading to the pairs of cylinders

Repainting and Finishing Metal Body Surface

M. C. Hillick tells automobile repairmen and painters the best way to proceed to secure good results in renovating the metal body surfaces of a high-grade car after it has undergone a long siege of the battering which invariably accompanies hard service on the road.

AUTOMOBILE repairmen and painters suffer much vexation of spirit in handling the metal automobile surface visiting the shop for repairs. Especially in the matter of painting repairs does no small trouble arise unless right steps are taken at the outset. The surface comes to the painter nicked and peppered with every manner of highway "pick-ups" from the minute atom of stone to the egg-size pebble. The problem confronting the painter is to dress these dents and defects up with a body of pigment that will stick closer than a brother, and level them all down to a sleek, uniform condition in which no one part has an advantage over another part.

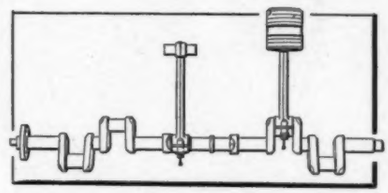


Fig. 3—Six-cylinder crankshaft, showing connecting rod with a pin fixed in the rod end

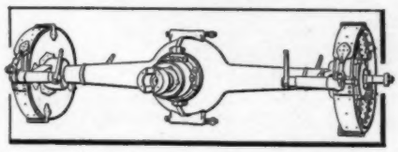


Fig. 10—Live rear axle of the drawn-steel tube type swelled at the center to accommodate the differential gear and bevel drive

The first step is to clean up the body of the car thoroughly, which means, of course, whipping the grease off with a tuft of cotton waste saturated with one part crude oil and two parts turpentine. Then run over the surface, if considerable varnish gloss remains upon it, with a roll of broadcloth moistened with water and dipped in pulverized pumice stone. This knocks down any surface roughage, gets rid of gaseous and other foreign accumulations, and puts everything in a clean, receptive state.

Then whip some good brand of mineral paint in one part raw linseed oil and three parts turpentine to a rather heavy paint consistency, and with this mixture touch over all the shattered bits of surface which have become bare right down to the metal. Parts scraped and partly worn off, but as yet not ground down or splintered off to the metal, should be touched up with the same mineral pigment thinned with one part raw linseed oil and six parts turpentine.

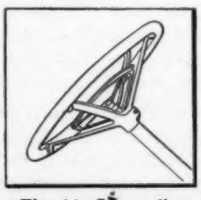


Fig. 14—Large diameter steering wheel with a considerably dished spider

Let this pigment cure and harden completely, after which fill up the cavities or depressions with hard-drying putty, bringing the putty up a little higher than the surrounding surface, thus allowing for possible shrinkage and giving a chance for rubbing the spot down perfectly level with the general surface. Give the putty forty-eight hours to dry, whereupon proceed with a block of artificial rubbing stone dipped in turpentine, or, if the insurance regulations permit, in gasoline, to scour these putty patches down to a perfect and smooth level with the surrounding surface. Avoid using water for the purpose of rubbing, for in case the surface is cut up with varnish fissures, the moisture will penetrate them and open them up to the extent of affording more trouble. In case the surface is to be brought to a finish at the least possible expense, touch the putty patches, after rubbing, with a bit of body color, and next over the entire surface flow a coat of varnish color, using enough varnish to cast a good gloss into the mixture.

When this coat is dry rub it rather lightly down with water and pulverized pumice stone, wash up very clean and good, put on the necessary striping, if any, pencil varnish the stripes and flow on a coat of heavy body finishing varnish.

In the event of making a better finish, instead of using the varnish color first, thin down some japan ground body color with turpentine, and to every eight parts turpentine use one part raw linseed oil. Then put the varnish color directly over this. Rub this coat when dry with water and pulverized pumice stone, wash up and apply whatever striping may be desired. Next, over this flow a coat of elastic rubbing varnish, which should be given anywhere from four to six days to dry. Rub, as before, with the water and pulverized pumice stone and finish with a high-grade elastic finishing varnish.

Whenever a metal surface comes in with the paint scaling and flaking, due to old age, rather than to service abuse or to accident or to a wrong system of building up the finish, the only remedy worth while is to use a hook steel scraper, and with it remove every part of the shaky material. Old paint foundations, to be worth painting over, must be sound to the core; otherwise, burn or tear them off.

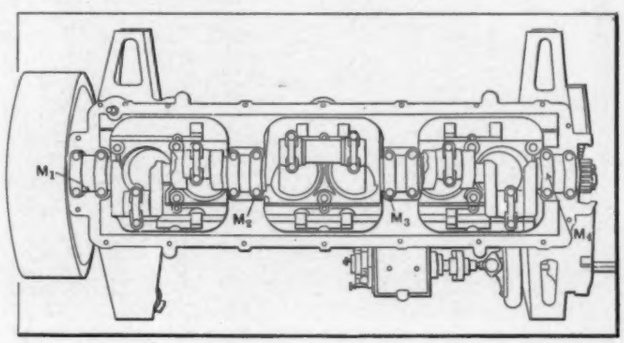


Fig. 8—Looking into the crankcase with the bottom half off, showing the capped main bearings

Reynolds Rotary Valve Motor

In the Search for Silence and Efficiency

Illustrating the new Reynolds rotary-valve type of motor that is just being brought out in Detroit, a strong company having been formed, with M. J. Murphy, who is president of the Murphy Chair Company and of the Security Trust Company, at the head, the vice-president being Walter S. Russell, who will be remembered as president and general manager of the Russell Wheel & Foundry Company, and A. McComb Campau, as secretary and treasurer. The board of directors includes Howard E. Coffin, vice-president and consulting engineer of the Hudson Motor Car Company, George H. Cheney, Prof. Herbert C. Sadler of the University of Michigan, and Cecil H. Taylor, with extensive plans for the considerable manufacture of this product.

UPWARDS of 20 years ago, when automobiles were scarcely seriously considered, a motor with this type of rotary valve was built in the plant of the J. I. Case Threshing Machine Company, and for several years this motor was made to do service in stationary gas engine work, thus presenting the beginning of the rotary valve idea in actual commercial pursuits. In the old days the question of noise was given but little consideration, but it was nevertheless true of the Raymond rotary valve that its performance was silent, and any troubles that came were readily traced to poor conditions of lubrication and the use of an inferior grade of cast gray iron. For some time past Vice-President Coffin, of the Hudson Motor Car Company, has been supervising the building up of the Reynolds rotary valve motor, and this effort has culminated in the finished product the general appearance of which is shown in Fig. 1. This motor is of the four-cylinder, water-cooled type with a block casting construction, and the ignition effort is done by a magneto M1, the latter being located on a finished face of the motor case, with the shaft for driving coming out of the case, taking power from the crankshaft by a suitably contrived gear. Oiling is accomplished by the lubricator L1, which is also power driven. Referring to Fig. 2 of the motor the carbureter C1 is attached to a curved uptake, which is flanged to the face of the cylinder,

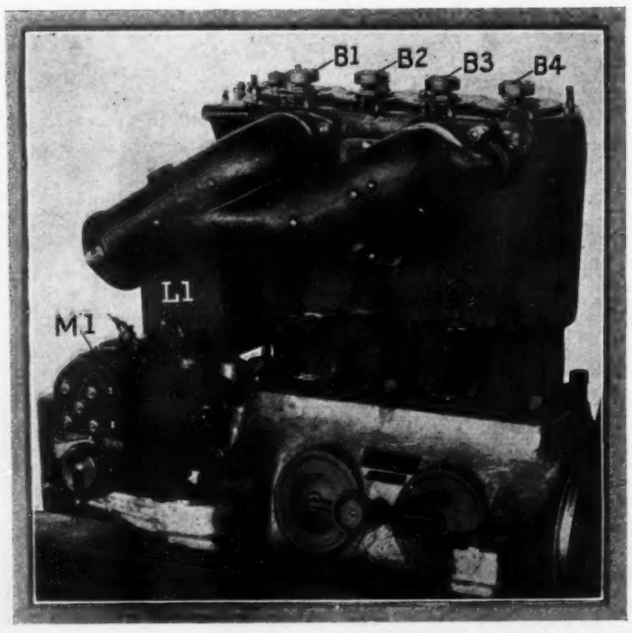


Fig. 1—Looking at the left side of the Reynolds rotary valve motor, showing the nesting of the magneto and the train of valve gears

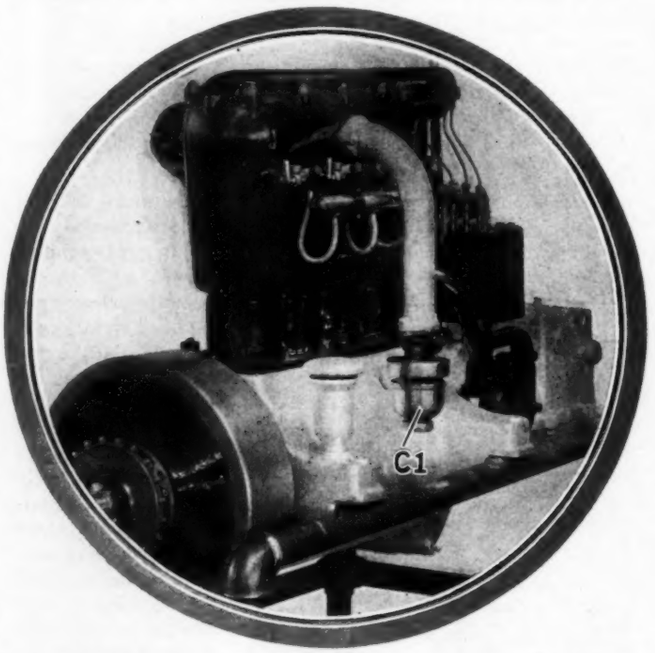


Fig. 2—Perspective of the motor complete with the carbureter in place, showing the system of wiring from the magneto

from where transfer ports radiate, with water-jacketing around them, they leading to the rotary valves in the heads of the cylinders, where the flow of the gas is controlled, supplying mixture to the combustion chambers, under four-cycle conditions. In Fig. 2 it will be seen that the wiring from the magneto leads up in a suitably contrived conduit to spark plugs located on the sides of the cylinders. Glancing at Fig. 1 and the heads of the cylinder with the cover off, a train of gears is exposed, each of which is attached to the spindle of its respective rotary valve, and annular type ball bearings B1, B2, B3, and B4, which fit in the cover, support the rotation of the valves as they bear on a flat seat which also serves as the dome wall of the combustion chamber—the valves are within the cylinders.

For a better understanding of the construction and arrangement of the rotary valves reference may be had to Fig. 4, in which is seen the rotary valve in the position V1 in the first cylinder, V2 in the second cylinder, V3 in the third cylinder, and removed in the fourth cylinder, showing the transfer ports P1 and P2.

The valve is of the damper type with a single opening, and since it rotates at half of the speed of the crankshaft, this opening uncovers the inlet and exhaust openings in the dome of the cylinder in accord with four-cyle relations, the ports in the head being in quadrature for the purpose. The valve is shown at B, and it is provided with a stout spindle with an oil hole

through the center, so that oil is fed through the spindle to the valve seat as it bears on the finished face of the dome. At C the valve cage is in place, and the train of gears comprising G1, G2, G3, and G4 mesh with each other, they being located on the spindles of the valves. Motion is imparted to this train of gears through the driving gear G1, which is attached to the upper extremity of the vertical shaft, the latter being driven from the crankshaft through suitably interposed gears, one of which is shown as G6 in Fig. 4. The gears in the train as they center on the spindles of the valves, are fastened to the spindles through an adjusting motion, the object of the latter being to enable the operator of the motor to time the respective valves independent of each other.

The motor is rated at 20 horsepower, and considerable care has been exercised to so cool the cylinder heads that the valves and the seats will retain a working temperature, and it has been figured out that an oil film will separate the valves from the

Fig 3—In the Reynolds plant at Detroit, showing the assembling of the motors

seats at all times. The ports are of generous size, and the transfers for the gas and the product are short and free from kinks, so that the suction losses are minimized and back pressure is aborted. In the oiling of the valves the force-feed lubricator taking its drive from the cross shaft supplies each valve independent of the other. The main bearings are lubricated by splash, the oil coming down from pockets cast in the side of the crankcase. A means is afforded for keeping the oil in its pockets when the motor is placed at an angle. There is a considerable measure of novelty in the design of the motor, as in the arrangement of the water-cooled exhaust pipe, the nesting of the water pump, the setting of the Eisemann magneto, and an ignition conduit which was contrived to meet the exigency following the placing of the spark plugs in the side walls and cylinders, it being impossible to put them in the cylinder heads, which position is occupied by the valves.

The Reynolds rotary-valve motor is self-contained, and comes complete ready for installation. The bore of the cylinders is 3 1-2 inches and the stroke is 4 1-2 inches. The connecting rod bearings are 1 7-8 inches by 2 5-8 inches, and the main bearings are 1 7-8 inches by 3 1-2 inches, excepting the flywheel and bearing, which has a length of 4 inches. The flywheel diameter is 14 inches, with a 4-inch face. The webb of the flywheel is dished, throwing the rim in the direction of the crankcase, thus centering the mass. The motor is 31 inches over all, with a 23-inch height. The weight of the motor is 370 pounds including the magneto, and its ability is estimated at 15 horsepower at 750 revolutions per minute, increasing to 20 horsepower with a maximum speed of 1,300 revolutions per minute. Fig. 3 shows the assembling of these motors in the plant of the Reynolds Motor Company at Detroit, Mich., and there is every indication of activity along light commercial lines, with the understanding that these motors will perform in automobile service, silently and well.

Sweden Likes Our Cars

Latest statistics show that the Scandinavians are using quite a number of American automobiles. The cars that seem to be preferred by them are mostly low-priced, but the Swede does not hesitate at paying a stiff price when convinced that the goods are worth it.

THE latest statistics giving details of the automobile industry in Sweden show that during the year 1909 passenger motor cars to the value of $508,216 and freight motor cars totaling $48,900 in value were purchased in the kingdom.

The motor cars which were purchased for passenger service came into Sweden from countries and in numbers indicated by the following table:

Countries.	1907.	1908.	1909.
United States	69	16	32
Belgium	30	40	23
Denmark	54	37	11
France	61	18	71
Germany	76	48	35
Italy	15	..	15
Netherlands	7	1	3
Norway	1	..	3
Switzerland	1	..	..
United Kingdom	25	15	16
Total	333	175	207

There is an ad valorem import duty of 15 per cent. on automobiles of foreign make coming into the country. It would be necessary to have a supply of repair parts on hand at all times in local depots, in the event of American manufacturers looking for business in the direction of Sweden. The motor cars in use now are mainly low-priced, although the Swede does not show a disposition to haggle over paying a stiff figure in case a machine is worth it.

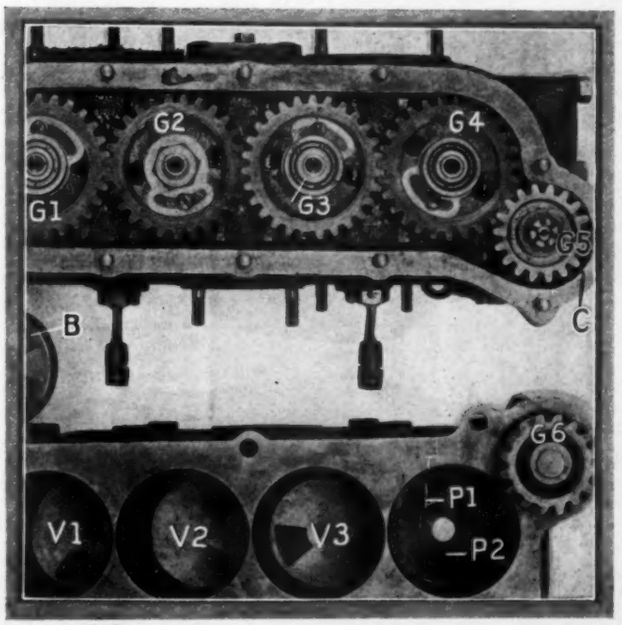


Fig. 4—Depicting the valve motion looking through the open ends of the cylinders, showing the valves and ports (B), presenting one of the rotary valves (C), showing the train of gears used to drive the rotary valves

What Is the Composition of Tire Cases

Editor THE AUTOMOBILE:

[2,677]—Being a novice and an automobile enthusiast, I naturally drink in everything that I hear and the tire problem occupies a conspicuous position in the convolutions of my mind, but I am unable to conclude that tires are made of rubber, even if I do hear so much about the effect of the automobile on the rubber market, and observe that everyone refers to tires as being of rubber. What is the principle of construction of cases, so called, and what are they made of?

Philadelphia, Pa. IGNORAMUS.

The case is the envelope which sustains the inner tube, the latter being filled with air under pressure, serving as the container thereof. It is the air that furnishes the resilient properties which are the most desired, absorbing the shocks that are due to impact of the automobile by virtue of its speed and weight, contacting with obstructions, of which poor roads have many. The case is made of cotton duck which is put through a frictioning process for the purpose of squeezing rubber into the interstices of the weave, presenting an exterior coat of the compound so that the layers of the fabric will adhere to each other when the case is built up and vulcanized.

Referring to Fig. 1, which is a section of a case, the bead B1 is of relatively hard rubber compound, over which the fabric is laid, thus forming the part that co-operates with the clincher of the rim to keep the shoe in place. The friction fabric I1, which is the inner layer, is given its coat of rubber on one side only, it being the idea to prevent the inner tube from sticking to the case, which it would do were the inner layer of fabric frictioned on the inside. Next to the inner layer of frictioned fabric comes the second layer of frictioned fabric F2, followed by the third layer, F3, of the same, and there may be five or six of these layers, although such a large number of frictioned fabric layers are rarely used in shoes. The layers F2 and F3 are frictioned on both sides, and the tread T1 is vulcanized to the frictioned surface of the outer layer, unless a layer of gum is interposed. In the laying up of the fabric, it is the custom to use a layer of gum between each layer of the frictioned fabrics in good examples of tires.

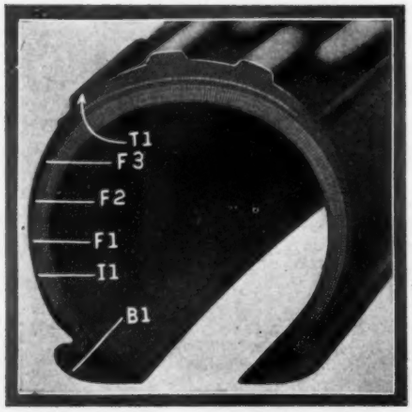


Fig. 1—Section of a shoe, showing the layers of fabric, construction of the bead and the laying on of the tread

It is the function of the fabric to sustain under the pressure of the air within the inner tube supporting same. It is the duty of the rubber compound, excepting that in the bead and in the tread, to serve as the binder of the fabric, so that the warp and woof of the weave will not cut each other, and it is also true of the rubber that it prevents water and mildew from getting into the cotton of the weave, thus protecting the fabric from the onmarches of these mushroom growths. The compound used in the frictioning work, if the tires are good, is high in Para gum, to which is added the vulcanizing materials and such other substances as will add to the density, permanence, elasticity, and strength of the gum. The compound used in the tread has its quota of toughening material, it being the case that the tread must sustain against the tangential forces and the rough work that comes due to contact with the roadbed.

Talking Tire Gauge Seriously Proposed

Editor THE AUTOMOBILE:

[2,678]—Having read letter No. 2,659 and the reply thereto in THE AUTOMOBILE of May 11, I take the liberty of calling attention to an effort on my part to settle this problem by means of a system involving the permanently attaching of a tire gauge which affords the additional facility of giving instant warning if the pressure falls below a certain predetermined minimum point. I worked out a plan and used a bell as the means for telling the driver of the automobile when the pressure in any one of the tires was too low to be tolerated. This idea is giving me good satisfaction, and I am inclined to the belief that there should be a demand for some such device, which I would be willing to supply were the indications good. I would be able to make a few hundred of these outfits during the coming Summer.

E. A. TERPENING.

Mokena, Ill.

Questions Complete Range of Automatic Ignition System

Editor THE AUTOMOBILE:

[2,679]—The automobile ignition advance idea as presented on page 1136 of THE AUTOMOBILE of May 18 is certainly attractive, and it opens the way to further refinements of cars, helping to soften the effect of the personal equation, and all that sort of thing, but I question the complete range of performance of the plan, even though the mechanism may be worked out so that it functions reliably. Let us take, for example, a motor that is running on a rich mixture at its lowest possible speed without load, and then put on a load, increasing the same without changing the speed, what would be the result? The ignition would remain at the point as indicated by the speed, but the load would change from zero to the maximum as represented by the ability of the motor considering a constant speed. I believe that the ignition would have to be advanced, even though the speed is the same, to get the best result. It would be interesting to have the ignition experts discuss this matter at some length and tell us where we are at.

R. W. A.

Philadelphia.

What Some Subscribers Want to Know

The Editor invites owners and drivers of automobiles who are subscribers to THE AUTOMOBILE to communicate their automobile troubles, stating them briefly, on one side of the paper only, giving as clear a diagnosis as possible in each case, and a sketch, even though it may be rough, for the purpose of aiding the Editor to understand the nature of the difficulty. Each letter will be answered in these columns in the order of its receipt. The name and address of the subscriber must be given, as evidence of good faith.

Indicating Curiosity About Standardization Activity

Editor THE AUTOMOBILE:

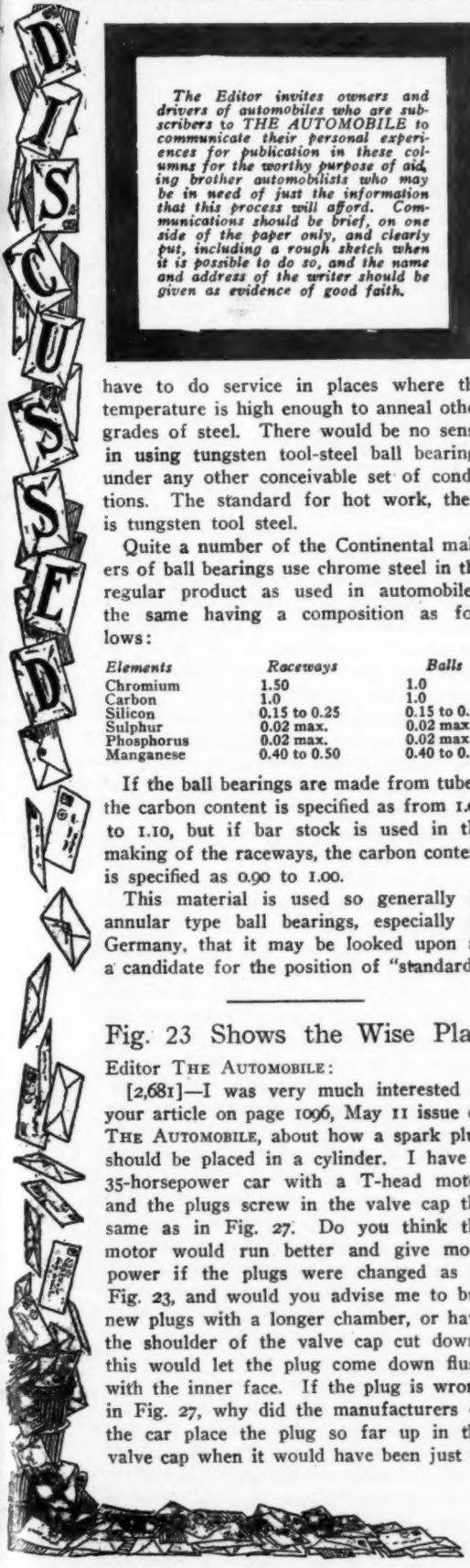
[2,680]—I appreciate the effort that THE AUTOMOBILE is making in the direction of conservative standardization work, but I am at a loss to understand why there are so many examples of ball bearings that do not seem to conform to any standard. True, the sizes of the ball bearings are much alike, but I am perfectly sure that the materials are not the same in the respective makes of ball bearings, and I wonder why one man should be using mild steel, case-hardening the same, and another man prefers to trust to a type of steel that seems to me as hard as some of the best grades of tool steel. I would greatly appreciate a little light on this subject.

C. V. S.

New York City.

Tungsten steel carrying not far from 20 per cent. of tungsten is used in the balls and races of anti-friction bearings that

What Other Subscribers Have to Say



The Editor invites owners and drivers of automobiles who are subscribers to THE AUTOMOBILE to communicate their personal experiences for publication in these columns for the worthy purpose of aiding brother automobilists who may be in need of just the information that this process will afford. Communications should be brief, on one side of the paper only, and clearly put, including a rough sketch when it is possible to do so, and the name and address of the writer should be given as evidence of good faith.

have to do service in places where the temperature is high enough to anneal other grades of steel. There would be no sense in using tungsten tool-steel ball bearings under any other conceivable set of conditions. The standard for hot work, then, is tungsten tool steel.

Quite a number of the Continental makers of ball bearings use chrome steel in the regular product as used in automobiles, the same having a composition as follows:

Elements	*Raceways*	*Balls*
Chromium	1.50	1.0
Carbon	1.0	1.0
Silicon	0.15 to 0.25	0.15 to 0.25
Sulphur	0.02 max.	0.02 max.
Phosphorus	0.02 max.	0.02 max.
Manganese	0.40 to 0.50	0.40 to 0.50

If the ball bearings are made from tubes, the carbon content is specified as from 1.00 to 1.10, but if bar stock is used in the making of the raceways, the carbon content is specified as 0.90 to 1.00.

This material is used so generally in annular type ball bearings, especially in Germany, that it may be looked upon as a candidate for the position of "standard."

Fig. 23 Shows the Wise Plan

Editor THE AUTOMOBILE:

[2,681]—I was very much interested in your article on page 1096, May 11 issue of THE AUTOMOBILE, about how a spark plug should be placed in a cylinder. I have a 35-horsepower car with a T-head motor and the plugs screw in the valve cap the same as in Fig. 27. Do you think the motor would run better and give more power if the plugs were changed as in Fig. 23, and would you advise me to buy new plugs with a longer chamber, or have the shoulder of the valve cap cut down; this would let the plug come down flush with the inner face. If the plug is wrong in Fig. 27, why did the manufacturers of the car place the plug so far up in the valve cap when it would have been just as easy to put it in like Fig. 23? Don't you think it was put in this position for some purpose? OWNER.

Red Hook, N. Y.

You will be justified in getting plugs with longer threaded portions so that you will approximate the conditions as they exist in Fig. 23 on page 1096 of THE AUTOMOBILE of May 11. It will be improper to machine down the cap to accommodate a short plug, since in thus proceeding you would alter the compression of the motor, making it less than it is.

Wants to Know How Threads on Bolts Are Measured

Editor THE AUTOMOBILE:

[2,682]—In the replacement of bolts or studs in my car I am confronted by the strange language that shop men use in describing their wares, and when I go for a bolt at the garage, I am asked such questions as: "What do you want, a 14-28?" or if I ask for 1-2 inch stud, the genial doctor at the wicket comes back and says: "How many threads?"

New York City. C. R. S.

The 14-28 screw referred to is a No. 14 (Stubbs gauge) screw threaded on the end with 28 United States standard threads to the inch. Fig. 2 shows a tap with a Vernier caliper set with the points just one inch apart, and if the threads are counted between the points it will be found that there are 10 of them. This tap would therefore be used in the tapping of a nut, or in the threading of a hole for 10 United States standard threads to the inch. If it is desired to thread a bolt instead of threading in a hole, a die is used, and the die would be so fashioned that the tap would screw into it; the die would therefore have 10 United States standard threads to the inch. In automobile work, the A. L. A. M. standard is used, but this simply means that the number of threads per inch is increased as compared with the number of threads per inch that are ordinarily used on the respective sizes of bolts, since the shape of the thread conforms to the Sellers standard in either case.

In the Timing of a Six-Cylinder Motor

Editor THE AUTOMOBILE:

[2,683]—Can you give me a diagram scheme for the valve setting of a six-cylinder motor?

A. P. MUILHING.

Cleveland, Ohio.

Proceed with any number of cylinders in the same way that a single-cylinder motor is timed. Time No. 1 first. Having completed this operation, time the next cylinder in the order of firing, and so on

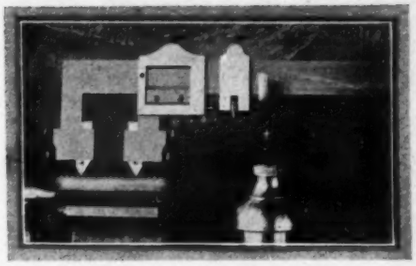


Fig. 2—Vernier caliper, showing its use measuring the number of threads per inch on a tap

until all of the cylinders are timed to conform to the timing diagram Fig. 21 on page 1053 of THE AUTOMOBILE of May 4. The order of firing is fixed by the maker of the motor, but since this order differs in the various products, considering the fact that you failed to mention the name of the maker, we have to suggest that you take the motor as you find it, and proceed as above indicated.

Information Afforded Is Meager

Editor THE AUTOMOBILE:

[2,684]—We are troubled somewhat with noise in the timing gears of our car. Can you give me a good recipe that will obviate this trouble to a certain extent? If you can, I will consider it a special favor. J. F. STAMPFER.

Dubuque, Ia.

If the timing gears make too much noise the treatment to give them depends quite a little upon their composition. If the gears are of metal and they ring, this sound can be deadened by running Babbitt metal around the rim inside, but in performing this operation it will be necessary to make the Babbitt metal adhere to the gear metal, and after the pouring of the Babbitt it will be desirable to set the gears up in a lathe and turn the metal down to a uniform contour. If the gears grind it is evidence of the fact that they are not properly centered, hence do not run on the pitch line. To remedy this difficulty it will be necessary to re-center the gears. This would be a formidable undertaking. If you merely wish to make the car run silently until you can induce someone to buy it, one practice is to soak the gears in molten beeswax. A better way would be to overcome the difficulty in a somewhat more permanent way, thus delivering a greater degree of satisfaction to the purchaser, or to yourself, if you intend to use the car in further service.

Broken Arm Due to Mysterious Back-Kick

Editor THE AUTOMOBILE:

[2,685]—I am suffering from a broken arm. The injury was incurred in cranking my automobile. I want to find the cause of the trouble, and fearing a recurrence of it, wish to avail myself of

your columns for an explanation. The engine has four cylinders, 4 1-2-inch bore by 5-inch stroke, with good compression and served by a Schebler carbureter of the water-jacketed type. It is a T-head engine with intake valves on one side, and exhaust valves on the other. It has one set of spark plugs, and these are placed over the intake valve. Ignition is by the Bosch dual system. Apparently all parts of the engine and ignition system are in good condition, for it starts and runs very well.

In endeavoring to start the car the operations were exactly the same as I have always used when the car has been standing some hours, *i. e.*, retard the spark as far as possible, open the throttle one-half, throw switch of coil on dash to battery position, and press button of vibrator to start if possible without cranking. The engine not starting, I pushed the starting crank handle in to engage the engine shaft; the crank handle hanging at its lowest point, my operation was to pull the handle up against compression for a quarter turn. I then repeated this operation perhaps three times, when an explosion occurred in the early part of the compression stroke throwing the crank handle in the opposite direction from which I was pulling and producing what I call a back-kick.

Any light you can throw on the matter will be appreciated I presume by many besides me. JOSEPH HALSTED.

Chicago, Ill.

Your motor is designed for a somewhat high compression with a view to smart performance, and in addition to some carbon deposit within the combustion chamber, there is a coating of scale on the exterior of the cylinder walls adjacent to the flame-swept surface; moreover, there is a deposit over the surfaces of the radiator within the water spaces, and when you cranked your motor it was warm and the spark was advanced perhaps 5 degrees; moreover, you failed to pull on the crank smartly, and the result has been stated by you.

The remedy to apply includes cleaning out of the combustion chamber and scraping the crust off the cylinder domes as shown in Fig. 17 on page 52 of THE AUTOMOBILE of May 4, after which make a caustic solution, using hot water and soda, and put the same into the cooling system, circulating it for half an hour, perhaps, and then substitute clean water for this solution and run for an equal length of time, finally removing this water, substituting the regular supply. Go over the connections of the ignition system, including the control, for the purpose of removing lost motion, and when you have completed these efforts and explorations, it remains for you to make up your mind that cranking is a serious matter, and safety demands that you go through the cranking effort smartly.

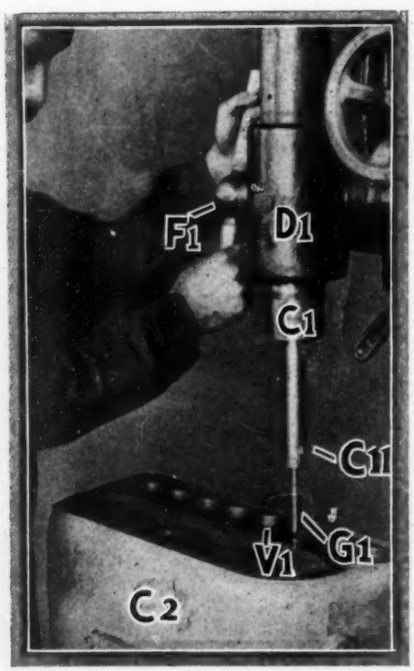


Fig. 3—Depicting the use of a drill press in conjunction with a cutter bar in the dressing of the metal above the valve seat in a motor cylinder

The Drill Press in the Private Garage

Editor THE AUTOMOBILE:

[2,686]—In the operation of my runabout I have lately decided that paying $15 per month to store the same in a public garage, considering the fact that the car gets no care at this price, is at a considerably greater cost than will follow if I put a portable garage in my back yard, and being something of a mechanic myself, it occurs to me that I might buy a couple of second-hand tools and put them in one corner of the little garage, with the hope that I will be able to make all ordinary repairs, remembering, of course, that a handy man can accomplish much at a bench, using chisels, hammers, files, and such like. I gather from having read some of your articles in THE AUTOMOBILE that a drill press has a wide range of use, and it occurs to me that I might do a little thinking for myself if you will give me a start. Will you be good enough to illustrate one use of a drill press that will have bearing upon my case? W. A. R.

St. Louis, Mo.

Referring to Fig. 3 of an ordinary type of drill press, the cylinder C2 is resting upon the platen of the drill press, and the wing cutter C11, in the cutter bar C1, is being lowered into the valve chamber so that the guide G1 will enter the valve stem bearing below the valve seat, and the operator by feeding the cutter bar down, turning on the handle F1, so that the wing cutter approaches the metal to be cut away, may then turn on the power and feed the wing cutter against the metal above the valve seat, thus dressing the same as a preliminary to a regrinding operation. All kinds of work of this character may be done on a drill press, although fixtures or clamps will have to be contrived to hold some types of work.

Wants to Know How to Take Care of a Motor

Editor THE AUTOMOBILE:

[2,687]—Being a subscriber to your magazine I would like to ask you a few questions.

1. How are valves ground, and what is the best method of cleaning out old oil in the motor of a four-cylinder unit system automobile? The car I speak of has a large drain plug and also two try cocks to tell the amount of oil in the motor after emptying the motor by opening the drain plug. When replacing there is always a small amount of that oil left in the motor even if I run the car up on a hill. I don't suppose the little oil left hurts anything, but when I put new oil in I don't like to have any of the old oil remaining.

Shreveport, La. A READER.

To grind in the valves proceed as follows: (a) detach the valve springs; (b) unscrew the covers over the valves; (c) get a screw-driver which will fit in the screwdriver slot on the tops of the mushrooms of the valves; (d) provide a quantity of valve grinding material such as may be had at any automobile supply store (one brand is known as Eureka compound); (e) remove the valve of the first cylinder, and after cleaning the seat of the valve and the cylinder inspect these seats and gain an idea of their physical condition; (f) smear a little Prussian blue over the seat in the cylinder, making a thin smooth coat; (g) put the valve back into place and twist it around with a screw-driver, exerting some pressure; (h) remove the valve from the cylinder and observe how much of the surface of the seat is coated over with the Prussian blue, the part that is not coated represents the zone of the seat that is not in contact, and is responsible for the leakage; (i) clean the Prussian blue off the valve in the seat; (j) apply a thin coat of the Eureka compound to the seat, using the coarse mixture if much grinding is to be done, a medium coarse mixture if the grinding is to be moderate, and the fine mixture if the grinding is to be put slight; (k) put the valve back into place and adjust the screw-driver into position, then with the right hand holding the handle of the screw-driver and the index finger of the left hand pressing against the end of the valve stem turn the screw-driver (exerting pressure) about one-half of a revolution each way, and after completing this screw-driver motion lift the valve off its seat by pressing upward on the end of the stem, and rotate it part way around, letting it fall on the seat at a new position, and then repeat the screw-driver operation, and

after alternating these movements a half dozen times, take the valve out of the cylinder, clean off the abrasive material, and see again the physical character of the seat. If the valve seat metal shows bright all over, it is a sign that an even seat has been realized, but if there is any question involved, repeat the Prussian blue performance, and get an idea of the rate at which the metal is grinding down to a true seat. Nothing remains but to continue the above operations until the valve is ground to a tight seat, using the fine grade of Eureka compound in the last operation, and when one valve is ground in, proceed with the remaining valves, one at a time, in the manner as before indicated.

It would be better to allow a little of the old oil to remain in the chamber than to use kerosene oil in the cleaning out of the crankcase, if there is any chance that some of the kerosene oil will be left in after the cleaning operation is concluded. The diluting of new oil with a small quantity of the old oil is far less likely to produce trouble than the other course. A little kerosene oil mingled with the lubricating oil has the effect of destroying the continuity of the film of lubricating oil in the bearings when the journal pressure is somewhat high. Good lubrication depends upon a continuous film of lubricating oil. Good lubricating oil has the property of thinning out under pressure without rupturing the film. Kerosene oil is noted for its absence of this property, and even a single drop of kerosene oil on the journal surface is sufficient to destroy the continuity of the oil film.

Another Advocate of Mixed Drinks

Editor THE AUTOMOBILE:

[2,688]—I have read with much interest the articles by Mr. Duryea and "Automobilist" in your paper regarding the use of cylinder oil in the gasoline for lubrication. I would like to say that I know from actual experience that Mr. Duryea is right in all he says. I have used a two-cycle four-cylinder car for upwards of 40,000 miles, where the oiling was done by putting same in with the gasoline and the lubrication was always positive and perfect. I have always used this same method on a two-cycle marine engine with perfect results. Mr. Automobilist has yet something to learn about the oiling of gasoline motors. Let him try it and see for himself, and then acknowledge the corn.

Baltimore, Md. G. H. SMITH.

Absolute Temperature Basis of Calculations

Editor THE AUTOMOBILE:

[2,689]—In the discussion of the thermic performance of the "fluid" used in automobile motor work the term "absolute temperature" appears with alarming frequency to one who is not acquainted with the situation, and while I do not desire to attempt the ramifications of the mathematics of the gas relations, I would be gratified to have you state what is meant by absolute temperature.

Buffalo, N. Y. J. G. S.

The thermometer measures "sensible temperature." The range of the thermometer is limited. The sensible temperature extends to absolute zero, although thermometers not being so designed as to read to the absolute zero of temperature, have a zero within practical limits, basing the same upon the melting point of ice, or the freezing point of water, which is:

32 degrees on the Fahrenheit scale,
0 degrees on the Centigrade scale,
0 degrees on the Réaumur scale.

The zero point on the Fahrenheit scale is therefore 32 degrees below the melting point of ice.

The absolute zero i reckoned from the boiling point of water, which is:

212 degrees on the Fahrenheit scale,
100 degrees on the Centigrade scale,
80 degrees on the Réaumur scale.

Considering the absolute zero it is 373.1 degrees Centigrade below the boiling point of water, from which taking 100 degrees Centigrade as the difference between the boiling point of water and the melting point of ice, and it may then be said that the absolute zero is 273.1 degrees below the melting point of ice. Scientists prefer to use the Centigrade scale in dealings of this character. In describing the absolute zero as 0 on the absolute scale it is claimed to be the point at which the volume of the perfect gas vanished.

Wants Agency of Car That Will Climb the Mountains

Editor THE AUTOMOBILE:

[2,690]—I would like to know one of the best makes of automobile companies that I could obtain the agency for. I want to sell them and want a good one, not too high-priced; one that will climb the hills and mountains well with lots of power.

Marlinton, W. Va. J. A. HOOVER.

Compression Leaks Through Defective Priming Cocks

Editor THE AUTOMOBILE:

[2,691]—I purchased an old second-hand car at a small cost expecting that I would be able to get a certain amount of service out of it, but the motor shows very little power, due perhaps to leakage of compression more than anything else, and more or less of this leakage, according to my observation, is through the priming cocks, which look to me like the ordinary kind that serve on the gas jets in my house. What is the best type of priming cock to use on motors?

Chicago, Ill. SUBSCRIBER.

By referring to Fig. 4 of a priming cock, it will be seen that the handle is weighted so that when the cock is closed gravity will hold it in the closed position, and a spring is employed on the end of the valve stem for the purpose of keeping the plug to its seat, thus preventing leakage and trouble in operation. You should have no trouble in the purchase of fittings of this type.

Water Boils, Engine Overheats, Knocks on Second Speed

Editor THE AUTOMOBILE:

[2,692]—Kindly tell me what is wrong with a motor that knocks while taking a grade on second speed and continues to knock after spark has been retarded, at the same time fires in muffler both before and after spark has been retarded, then boils water out of radiator and balks. On the level motor runs well except for tendency to overheat.

Fredonia, N. Y. STALLED.

Pre-ignition is the cause of your trouble, due to presence of carbon deposit inside the cylinder or an over-rich mixture and the points of the spark plugs remaining in an incandescent state. All the symptoms point to the latter, which will cause deposit of carbon in a very short time.

Question Respectfully Referred to the Makers

Editor THE AUTOMOBILE:

[2,693]—Being a reader and subscriber to THE AUTOMOBILE I would like to know in your next issue which has the fastest records, the Remy magneto or the Bosch, and which is the best magneto?

Lead City. FLOYD KLOPP.

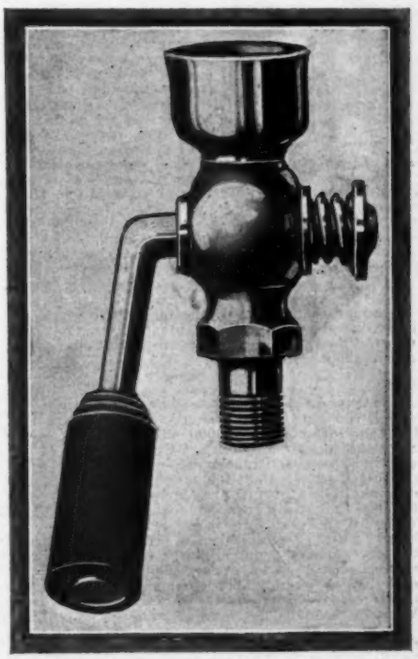


Fig. 4—Showing a well-designed priming cock for use in the cylinder of a motor and a spring on the stem to keep the plug from jarring off of its seat

Meeting Recurring Troubles

Presenting a Series of the Most Probable Cases

A series of correlated short stories, accompanied by diagrams and characteristic illustrations, including the nature of the troubles that are most likely to happen to automobiles, discussing their causes and effects, all for the purpose of arriving at a remedy. It is the aim, for the most part, to show how these troubles may be permanently remedied, and as a secondary enterprise it is indicated how the automobilist can make a temporary repair, thereby enabling him to defer the making of a permanent repair until a convenient time arrives.

VALVES MAY BE REFINISHED IN A DRILL PRESS—The cost of making repairs in the average poorly equipped repair shop is considerably in excess of reason, and this is in the face of the fact that an ingenious repairman would be able to do the best class of work even with a poor selection of machine tools, and in illustration of this point reference may be had to Fig. 72 showing the section of a cylinder through the valve with the valve removed and a cutter bar inserted so that the wing cutter is in the position of facing off the surface above the seat of the valve, the cutter being guided on the top side of the work by means of a plug that is screwed in place of the regular valve cover. The cutter bar is a piece of cold-rolled steel with the cutter inserted through a round hole that is bored through the diameter of the bar, and the set-screw shown is used to lock the cutter down after it is adjusted out so that the cutting edges are in a position to do the work for which they are intended. After facing off the excesses of metal above the seat, the cutter bar is removed and a cutter bar, as shown in Fig. 73, is substituted so that the cutter ground to an angle of 45 degrees is lowered down against the valve seat for the finishing of the same. These are all perfectly simple operations and the work may be done in a drill press, setting the cylinder on the platen of the same and inserting the cutter bar in the socket of the drill press spindle, for which purpose the upper extremity of the bar is given a Morse taper, agreeably to the size as indicated by the drill press available, or a three-jaw chuck may be used if the occasion requires. There are a considerable number of operations that may be done on a drill press, and it is one of the relatively inexpensive tools that may be had for use in an unpretentious garage repair shop.

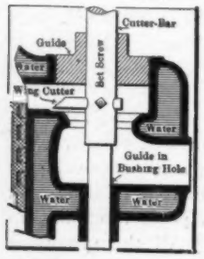


Fig. 72—Section of a cylinder through a valve, showing a cutter bar in place and a wing cutter adjusted to take metal off the cylinder above the valve seat

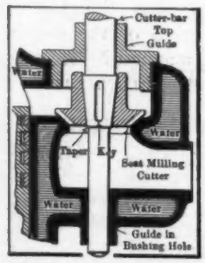


Fig. 73—Section of a cylinder through a valve, showing a cutter bar in place and a milling cutter adjusted to remove metal from the valve seat

STRAINS ON FLYWHEELS.—The strain on a flywheel rim due to centrifugal force is expressed by the formula $S = .00005427WRN^2$, in which S is the strain in pounds, W the weight of the wheel in pounds, R the mean radius of the wheel in feet and N the number of revolutions per minute. The formula is derived from this by finding the strain per square inch of sectional area of a cast-iron wheel, which would be $S_1 = .000027V^2$, in which V is the velocity of the rim in feet per minute; it has been found that a tensile strength of 10,000 pounds is all that can be reasonably assumed, and taking a factor of safety of 10, $1{,}000 = .000027V^2$, whence $V^2 = 1{,}000 \div .000027$, and $V = 6{,}085$.

Taking into account the greater weight of steel, the strain per square inch of a steel wheel would be $S_1 = .000029V^2$. The determining quantity is then the tensile strength of the steel to be used, divided by a reasonable factor of safety. A 22-inch wheel turning at 5,000 revolutions would have a peripheral velocity of 28,800 feet per minute, which would give a strain per square inch of 24,000 pounds. Whether this would be safe or not depends of course on the steel.

VALVES IN THE HEAD MUST BE PREVENTED FROM DROPPING DOWN—The types of motors that are so designed that the valve mechanisms are in the head are usually arranged with cages, and the mushrooms of the valves are prevented from dropping down into the cylinder in the event of the breakage of the stem. Fig. 74 shows a valve mechanism in the head of a cylinder of the type eliminating the use of a cage, and, should the valve stem rupture, the mushroom and some part of the stem will fall into the cylinder and ruin the highly polished walls of the same long before the unfortunate owner of the car will arrive at a conclusion as to the source of his trouble. If the valves must be so placed that this difficulty is threatening, it remains to use the type of metal in the stem that will be the least likely to rupture in service. For this type of work it is more than likely that the stem should be of puddle iron riveted to a nickel mushroom. The nickel may be of the grade carrying not less than 20 per cent. nickel, or of 35 per cent. nickel, which is a regular brand, but there is nothing to prevent using nickel carrying over 96 per cent. of this element. The puddle iron is a type of metal that will stand an enormous amount of shock and is little affected by temperature conditions. This product is the nearest to pure iron that can be had in a commercial way, the composition being substantially as follows:

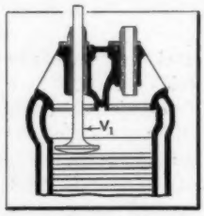


Fig. 74—Section of a cylinder with valve in the head showing the valve dropped down on the piston

Carbon.	Silicon.	Sulphur.	Phosphorus.	Manganese.
0.05	0.20	0.01	0.011	0.35

An inspection of this table of chemical contents shows a very small increment of carbon with sulphur and phosphorus at a marvelously low ebb, and the other contents agreeable to the object sought. It is common practice among the makers of mediocre product to substitute Bessemer steel for puddle iron; it is cheaper, of course, and the carbon content is usually about 0.08 point, but the sulphur and phosphorus contents are always above 0.10, and frequently as high as 0.18. A product such as this has no place anywhere in the makeup of an automobile.

THREE-POINT SUSPENSION, AND ITS ADVANTAGES.—By three-point suspension is meant the hanging or fastening of some one or more parts of an automobile by three points only, instead of the more usual four, six, or more. In hanging an engine from three points, for instance, this may be one in front and two at the rear end, or two in front and one at the rear. In actual practice, however, the former method is followed more often than the latter. The same, of course, applies to transmissions, and other parts as well as to engines.

The advantage of this form of suspension lies in the fact that at times one road wheel rises higher than the other by an appreciable amount, or sometimes both wheels on one side rise quite a little distance above those on the other side. This naturally twists and thus strains the chassis frame. The latter has, however, some slight freedom, but if the engine is rigidly bolted to a subframe by four or six points, when one side rises above the other, or when one side of the frame is twisted, the result is to twist the supporting arms of the engine. This may easily result in a breakage of the same. With the three-point suspension, on the other hand, the single point is pivoted and the whole thing may turn on that point. This allows the plane of the two-point-supported-end to twist out of the former plane, but carrying the engine with it as a whole, and consequently doing no damage whatever. There are other supposed advantages of this form of suspension, but this is the principal one. In some form or another, nearly every manufacturer uses the three-point suspension.

That is to say, the three-point suspension for some one or more parts is used by many manufacturers, who do not make much of it in their advertising or other literature, but the fact remains that suspension is a true three-point one, nevertheless.

CORK INSERTS HAVE PECULIAR MERIT FOR CLUTCHES—In many of the older makes of cars the clutch designs were below the fitting requirement, and the leather facings were applied to the cones of the clutches without the use of springs, the latter being for the purpose of pressing the leather out radially, thus permitting it to engage the mating surface softly at first, but firmly in the long run. It is a simple undertaking to fit cork inserts into the leather, as indicated in Fig. 75, it being a mere matter of cutting circular holes in the leather at equidistant points around the periphery, beveling the leather around the edges of the holes so that when the cork is cut into discs and inserted in the hole the beveled edges of the leather will overlap the cork and prevent it from coming out. Even an excellent grade of linoleum will do this work, the latter being composed of cork, which is first ground fine and then mixed with a cementing material, after which it is rolled out under presses and the enormous pressure to which the mixture is subjected binds the particles of the cork into a firm relation with each other, to which relation they hold with great tenacity, and the cement used in this work is oil- and heat-resisting to a high degree. In relation to cork for use in clutches, and in brakes as well, it has the virtue of serving its intended purpose, even when lubricating oil is smeared over the clutching surfaces, and the coefficient of friction of the cork to metal is as high as 0.35 under the best conditions, and rarely falls below 0.25, even when oil is present on the surfaces. This high coefficient is attended by other efficacious qualities, and, remembering that the coefficient of metal to metal is rarely equal to 0.16 and quickly falls to 0.08 if oil is present on the surfaces, it will be readily seen that the cork offers an excellent opportunity to the repairman to take an automobile that has a poor clutch and make it work.

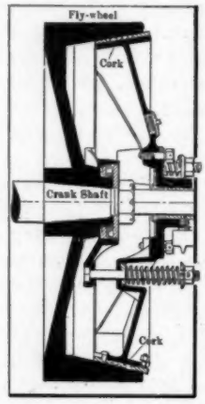


Fig. 75—Section of a flywheel and a cone clutch, showing the application of cork inserts in conjunction with a leather facing

CHEMICAL COMPOSITION OF GASOLINE—Taking the chemical composition of hexane, C_6H_{14}, as that of gasoline, its combination with the oxygen of the air to form carbon dioxide, CO_2, and water (or rather steam), H_2O, may be expressed $2C_6H_{14} + 19O_2 = 12CO_2 + 14H_2O$. From the atomic weights of the elements involved, the weight of air necessary for the complete combustion of 1 lb. of C_6H_{14} is found as follows:

The atomic weight of C is 12, that of H is 1, and that of O is 16; thus the molecular weight of C_6H_{14} is $6 \times 12 + 14 \times 1 = 86$; and the weight of the combining oxygen $19 \times 16 = 304$. Thus for the complete combustion of 1 lb. of C_6H_{14}, $\frac{304}{86} = 3.54$ lbs. of oxygen will be required. Since 1 lb. of dry air at 60° F. and 14.7 lbs. pressure contains only .23 lb. of oxygen, $\frac{3.54}{.23} = 15.39$ lbs. of air are necessary for the complete combustion of 1 lb. of gasoline. This mixture proportion of 1 : 15.4 is known empirically to be that which will develop the highest temperature and pressure in a gasoline engine cylinder with a compression pressure of 70 to 80 lbs.

Before proceeding to the heat necessary for fuel vaporization it should be determined at what lowest temperature the proportion of 1 of fuel to 15.39 of air, as above, can be maintained. There is a definite limit to the amount of vapor that can exist in a unit volume of mixture at any given temperature. If the vapor is at a certain temperature and pressure, a lowering of the temperature (the pressure remaining constant) will cause a condensation of some of the vapor, and consequently an impoverishment of the mixture.

SUGGESTING A GOOD TAKEUP FOR A MAIN BRAKE ROD—It is difficult to get the average owner of

an automobile to understand that, in the adjusting of the brakes, if the brake shoes wear down but a small amount this wear is multiplied in the ratio of 22 to 7 as a primary consideration, and it is further accentuated due to the lever advantage of the toggle or the cam or the screw, depending upon which of these principles is used in the mechanism. It is desirable to have some means at hand whereby the length of the main brake rod may be changed, making it longer or shorter, as the exigencies of service would seem to indicate, but the means available, as a rule, are too clumsy to attract the notice of an automobilist who merely wishes to ride in his car and enjoy the service rather than to put on old clothes and crawl around under the car trying to get a vantage point for removing the cotter pins prior to the taking down of the yoke, so that the yoke end may be screwed out on the rod thereby lengthening the overall of the same. A very simple idea that is used on Lozier cars is shown in Fig. 76. It may be contrived by a man of no great skill if he will take a suitable size of turnbuckle and flatten down one arm of the same and thereafter drill a hole in the flattened part to accommodate a latch which may be fashioned out of a piece of flat steel; with this device in place, if an adjustment is to be made, all that remains is to unlatch the turnbuckle and give it a few turns in one direction to shorten the length of the rod and in the opposite direction to increase the length. When the adjustment is made the latch may be snapped back into the position of locking, thus preventing the turnbuckle from drifting during service.

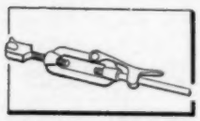


Fig. 76—A turnbuckle fitted with a latch for locking the same in position, suggesting the use of this device for the lengthening of brake rods

VISCOSITY OF GASOLINE LOWERED BY TEMPERATURE INCREASE.—Temperature assumes a great importance as affecting mixture proportions, *i. e.*, variations in the temperature of the liquid fuel within the nozzle. Gasoline is commonly thought of as having a very low viscosity. This is true, but the viscosity of gasoline is lowered quite rapidly with temperature increases. The comparative weights of gasoline of .71 sp. gr. flowing through the same passage and under the same pressure difference, with variations in temperature, are given in the following:

Temperature °F...	50°	59°	68°	77°	86°	95°
Weight in unit time.	1	1.073	1.145	1.212	1.27	1.335

With the fuels of higher specific gravity the increase in quantity with increase in temperature assuredly is higher.

The above change in the weight discharged with change in temperature throws some light upon the tendency of carbureters supplied with heated air from a chamber about the exhaust manifold to "lose" their adjustment. With heated air supplied in this way it has been repeatedly observed that the temperature of the air entering the carbureter will vary as much as 30° F. under changing conditions of running, the surrounding atmospheric air being at between 70° and 75° F.

Since in most carbureters the greater portion of the nozzle is so placed as to be directly in this heated air column, it stands to reason that the temperature of the nozzle walls, and consequently that of the fuel flowing through, will follow that of the air with a difference of but a very few degrees. If a constant initial air temperature could be maintained through the main air port, it would make no difference what temperature was employed, but with the exhaust manifold as the source of heat it is an impossibility, since its own temperature will vary from 300° to over 1,000° F.

Of course the velocity of the air through the heating chamber will vary so that the higher velocities will be simultaneous with the higher temperatures, and this will tend toward constancy of temperature, but the relationship of the velocity to the temperature cannot be made such that a given temperature will be maintained to within more than 10° or 15° F.

PEDALS SHOULD BE PREVENTED FROM SWINGING TOO FAR IN THE DIRECTION OF THE DRIVER'S SEAT—Pedals placed to actuate the clutch and braking mechanisms on automobiles play in a slot in the footboard, and the arc of travel in the direction away from the driver's seat is controlled by the takeup whereby the clutch or the brakes are actuated. But in the opposite direction there is nothing but the slot in the footboard to limit the travel of the pedal, and in quite a number of the older types of cars the footboards were made of wood and the slots were cut with a considerable increase in the number of degrees in the arc described, as the designers no doubt claim to afford a sufficiency of the arc of travel, and a measure of the same to spare. It is annoying to have the spring pull the pedal so far back that a cramped position must be taken in order to get the foot onto the pedal. An overhauling latch, as shown in Fig. 77, would obviate this difficulty, and, as will be understood, the latch would not interfere with the working of the pedal in the forward direction, but the feet of the two members of the latch would engage as the pedal swings back, thus preventing it from swinging beyond a certain predetermined distance. This would save placing dependence upon a slot in a footboard.

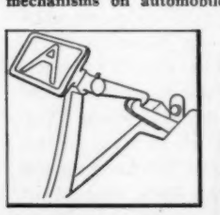


Fig. 77—A latching device for use on a pedal to prevent the same from traveling too far back

COMPOUND FOR NICKEL PLATING BRASS SURFACES.—In the latest method of nickel plating all that is necessary is to prepare the rubbing powder and apply it, using a wet rag. The powder is compounded of:

Nickel ammonium sulphate	60 parts
Metallic magnesium	3 parts
Chalk	30 parts
Talcum powder	7 parts

The process is electrolytic; magnesium, being highly electropositive, forms the anode, while the surface to be coated forms the cathode. Due to the "local action" set up when this compound is applied to the metallic surfaces to be plated the nickel in the solution will plate onto the surfaces just as well as when the plating is done in the conventional way.

The metallic magnesium particles must be protected from oxidation, and this is accomplished by bathing the particles of magnesium in a bowl of any wax that will dissolve in gasoline, as resin. The wax will form a protecting coat over the magnesium, but when the plating mixture is being rubbed onto the parts to be plated, the wax will be detached from the surfaces of the magnesium particles so that it is not a detriment in any way. There is no other complication to consider, and the plating powder may be mixed and stored until it is desired for use.

CLUTCH SPINNING INTERFERES WITH SLIDING OF GEAR.—Some clutches are of large diameter and so heavy that the stored energy is more than can be disposed of in a short time. It is impossible to slide the gears before they are reduced to nearly the same speed and the flywheel effect of the clutch interferes with this demand. There is only one way to apply a remedy and that is to attach a "drag" to the clutch. This can be done by finding a surface for a small brake-shoe and figuring out a motion for manipulating the same. The drag should come on just as the clutch is released. Cork inserts in the face of the drag will make it work better than it will if the contact is metal to metal.

THE USE OF A CONDENSER IN CONNECTION WITH A SPARK COIL—The function of the condenser, as it is employed in a spark coil, has been variously stated by many authors, but it is doubtful if automobilists are familiar either with the design and construction of the condenser or with the facts in relation to its use. Fig. 78 is a diagram of a spark coil showing the condenser D composed of laminæ of tinfoil with intervening laminæ of oiled paper or other insulating material, the connections of the tinfoil being as shown. In connecting up the condenser to the spark coil one leg of the condenser connection goes to the battery and the other leg of the condenser connection goes to the lead of the secondary winding of the coil as it passes to the contact button V. The contact R is in the trembler, and the high tension coil is designated as C and S, while the low tension coil is identified by the letter P. The spark plug G has a lead to the other end of the high tension coil. It is the function of the condenser to prevent destructive arcing at the contact points and to fatten the wave of electromotive force which has the effect of swelling the wave of the resultant current so that the useful power in watts of the coil is increased without, however, burning out the contact points. If the condenser breaks down, or if an open circuit develops in its leads, this fact will be indicated by the drawing out of a hot spark at the contact points and they will be dissipated with considerable rapidity in consequence. Moreover, the efficacy of the spark-coil will be largely diminished. The condenser is capable of doing this useful work on account of its capacity for an electric charge, and its further ability to deliver the same back into the system at the propitious instant. The condenser, being made of relatively thin sheets of tinfoil that are insulated from each other by oiled paper, or fabric, is a delicate device and it must be protected from dust and dampness or shock in order to preserve its functions.

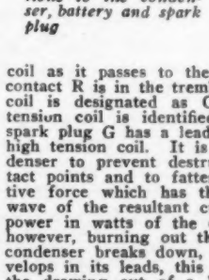


Fig. 78—Diagram of the wiring of a spark coil, showing connections to the condenser, battery and spark plug

METAL FOR BEARINGS.—A very good metal for bearings, and one that should give satisfaction, is Fahrig metal. The composition of this metal is substantially 90 per cent. tin and 10 per cent. copper. There is a very small amount of impurities in either metal, but not sufficient to materially alter these percentages. New metal must be used, otherwise the proportions cannot be correctly ascertained. This table shows some of the properties of Fahrig metal:

Crushing strength 38,500 pounds per square inch
Tensile strength.. 20,500 pounds per square inch
Elastic limit..... 3,600 pounds per square inch
Molecular temperature 1,000 degrees Fahrenheit
Anti-friction angle..... 77 degrees

In casting Fahrig metal it should be covered with charcoal and heated to a dull red before "teeming."

TIRE LIFE IS LARGELY DEPENDENT UPON THE SHAPE OF THE CLINCHERS—In the course of time, as inventors licensed their many ideas and for trade considerations, many shapes were given to clinchers and the beads of tires were in great variety. The result in practice may be inferred and chance has much to do with the fitting of the beads of the cases in the clinchers of the rims. Obviously, the beads of the tires will grow "corns" if they are pinched by the clinchers, and certainly the pinching propensity will be present in every instance of a poor fit. Taking Fig. 79 as an example of a snug fit of the bead of the casing with the clincher, and comparing this fit with Fig. 80, it will be seen that the dimension of the head at F is greater than the space afforded by the clincher and the curl of the clincher at C affords a knife-edge which will quickly cut the fabric and the gum so that the bead through the section A as it is forced into the cavity for the distance D will be crushed. The clip G is also a bad fit, under the circumstances, and a tire that is required to serve under these conditions is scarcely likely to give a good account of itself. Fig. 81 shows the bead of the clincher as it is pressed into the cavity for the distance D, and it indicates how the edge of the clincher at C bites into the wall of the rim and the bead is also indicated as it is crushed into the cavity at A. Fig. 82 shows the clincher somewhat expanded so that the cutting at C is avoided and there is room for the bead at A, thus saving the fabric at the points BB, but even this fit is poor since the shape of the rim at the junction of the clincher fails to accord with the contour of the bead over the bearing surfaces. Fig. 83 shows the clip G pressing the beads into the clincher, and the clip, being too large for the work, causes the rim to cut at the curl C against the fabric B, compressing the bead A, thus indicating that the clip G should be used in a tire with a clincher of a greater distance E, and that the distance D should be somewhat greater than it is; moreover, the distance N should be slightly increased. There are a large number of clinchers of this class in use, they having been employed prior to the introduction of detachable and demountable types of rims, and the practice in these days of adopting tires of a larger section for a given diameter must accentuate these troubles so that tire life falls below a reasonable expectation.

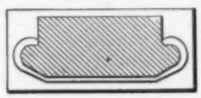


Fig. 79—Showing a snug fit of the bead of a casting in a clincher rim

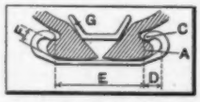


Fig. 80—Showing a clincher rim that is too small for the case

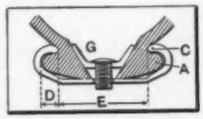


Fig. 81—Showing the clip pressing the bead of the case into an ill-fitting clincher.

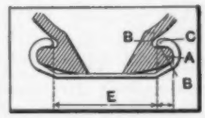


Fig. 82—Showing a clincher rim that is large enough for the case, but the shape does not conform to the contour of the bead

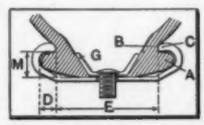


Fig. 83—Showing a clip that is too large for the clincher pressing the case against the curled edges of the rim

FORMULA TO FOLLOW IN TURNING BAUMÉ TO SPECIFIC GRAVITY.—

$$\text{Specific gravity} = \frac{145}{145 - {}^{\circ}\text{ Baumé}} \text{ at } 60^{\circ} \text{ Fahrenheit}$$

e. g. 15.0 Baumé—1.115 specific gravity.

Peeps Thro' Goggles at Distant Lands

What the Foreigners are Doing in Automobiling

The United States Government, through its Consular Service, has facilities for gathering all sorts of trade information. Many interesting items concerning the automobile and allied industries in foreign countries, along with the opportunities for trade extension as they arise, are set forth.

JAVA, that East Indian Archipelago Island, with its fertile valleys and, with the exception of Hawaii, the possessor of the largest volcano in the world, is particularly favored by Nature with good roads, as if in anticipation of affording automobilists suitable highways. A bright sign of the times is found in the fact that the taxicab is working its way the entire length and breadth of this slim strip of Indian Ocean land. A number of public motor-car services have been opened within the last month, notably between Benkollem and Palembang; Indramajo and Cheribon; and Deli and Asham. Service has also been established at Sourabag and Batavia.

Bombay is rapidly keeping pace with the world's spirit of enterprise, especially in the matter of providing municipal utilities. The city authorities have adopted the use of the automobile for the fire brigade. The first engine arrived a few days ago and has already been put into successful commission. It is a gasoline motor, modernly equipped with a turnable fire-ladder built in four sections. At such times as the ladder is not in use it is carried horizontally above the automobile chassis. The machine easily attains a speed of from twenty to thirty miles over level highways.

The Portuguese Government has announced that, hereafter, complete automobiles will be obliged to pay a customs duty of $32.40 on the Cape Verde Islands, that famous group of ten, in the Atlantic Ocean, 200 miles west of Africa. Repair parts intended for use of automobiles already in commission on the Islands will be admitted free of duty. A duty of 5 per cent. ad valorem is placed on gasoline.

A schedule just made public in Berlin shows that the receipts of one public passenger-carrying concern, the Berlin General Omnibus Company, rose 187 points in 1910, as compared with the 1909 income. Although it is an established fact that the earnings of the buses increased 18.8 per cent. during the same period, the expenses also increased 20 per cent. Berlin dealers explain that this is not remarkable, in view of the high price of rubber tires.

Sir C. Henry has just introduced a bill into Parliament which seeks to enact that the owner of an automobile in England shall neither let, lend or permit his machine to be employed for the purpose of carrying electors during election times to or from the poll of any election district. Should he knowingly permit such use of his automobile, he shall be adjudged guilty of an illegal act.

The London municipal authorities have just issued figures showing that 170,101 persons resident in London in 1910 took out motor-car licenses, this being a gain of 4,883 licences over the previous year. The amount of income from these licenses was about $960,000, or $170,000 in excess of the sum realized in the year 1909. Of this sum, about $100,000 is accounted for by the new system which is in vogue of taxing automobiles according to the horsepower with which the machine is credited.

In England they have a way of doing things which redounds to the benefit of the public at large. For example, the amount of taxes paid on account of automobiles and gasoline is hereafter to be devoted to widening the roads at spots which are considered dangerous; making improvements at corners and junctions; building new bridges, or reconstructing old ones; treating macadam roads with tar-spray; and resurfacing these highways. With the approval of the Treasury, the Road Board has made advances to the County Councils of the various municipalities of England, and to other highway authorities, notably in Linlithgow, Lincolnshire, Northamptonshire, East Suffolk, Oxfordshire, Essex, the Isle of Ely, West Sussex, Norfolk, Cheshire, Pembrokeshire, Shropshire and Rutlandshire. The list which has just been issued is the second published since the plan went into effect a few days ago, the present list referring to an appropriation of $345,000.

In the event of an American house intending to open up a business in Germany, it may be to the firm's advantage to organize under the German laws. At present, the German business of some American mechanical specialties is being carried on under the Imperial laws. Not only from a commercial standpoint, but in a legal sense such a course has been found to the American manufacturer's advantage. It has the effect of preventing prejudice to arise against the foreigner. Besides, local dealers are apt to take hold of the American product with a greater amount of faith in the product. Of course, the organization under the Imperial laws leaves the incomer liable to suit the same as a German concern. This has a disadvantage.

Germany, with 60,000,000 population has on her registration lists 46,922 passenger automobiles (the 1910 census) as compared with 39,475 in 1909; 34,244 in 1908; and 28,815 in 1907. There are 3,019 commercial cars at the present time, against 2,252 in 1909; 1,778 in 1908; and 1,211 in 1907.

Germany's gain in automobiles of from 16 to 40-horsepower was 200 per cent. from 1906 to 1910. The 16-horsepower machine has gained 120 per cent.

Germany has scored fewer accidents due to the automobile during each succeeding year since 1907 although the volume naturally has increased greatly. This is ascribed to two reasons: The constantly growing reliability and stability of the automobile; and the enlargement of the capabilities of drivers. The number of accidents for the year ending in September, 1907, was 2,419, as compared with 2,945 in 1910, although there had been an increase of more than 10,000 cars during this same period.

Germany had only 127 automobiles of over 40-horsepower in January, 1910, the number in 1907 having been 54. That which is known in America as the high-power automobile is not popular in Germany.

Madrid, Spain, purchased 326 automobiles in 1910, thus bringing the total number in the city, according to registration figures, up to 1,051—practically all of European make. The Spanish Government is doing everything in its power as a nation to make automobiling a popular pastime. That is, the Government is paying out huge sums for the building of roads. This fact, coupled with the growing custom for automobiling since the sporty (and very popular, in spite of adverse reports) young King began to set the pace and blaze the way in which so many of the people are following, is having the effect of rapidly changing the opinion of those conservative old Dons who have reveled in horseflesh, if for no other reason than to see the poor horse gored by the mad bull. But the automobiles sold in Madrid—or in any other part of Spain—are in the main not American made. Nor is the American automobile trade in Spain going to grow of

its own volition. The American manufacturer will find it incumbent upon himself to jump into the breach as an initiative and pioneer the work by degrees. Spanish dealers will not push American goods. This it not owing to the little unpleasantness which caused Americans and Spaniards to fire at one another across the land of Cuba, but rather to the fact that so long as the American manufacturer fails to emulate European manufacturers the Spanish dealer will continue to encourage the sale of European-made automobiles and accessories. Capable, Spanish-speaking salesmen, a good display of machines and parts and plenty of supplies and parts in the event of breakdowns are indispensable factors in the building up of a trade in Spain. The European manufacturers never allow their stock of accessories to run low, being very careful to maintain branch houses in the Spanish cities. The shopkeepers having the management of these branches do not make any effort to collect for goods sold through their efforts. They keep a strict account of stock, and furnish the respective manufacturers with a statement of the goods with which they supply each dealer. The manufacturer draws upon the dealer at intervals for the amount due him. The European manufacturers also employ men in the locality whose business it is to bring their automobiles to the notice of prospective customers. In this way they make it almost impossible for the intending buyer to inquire about American-made automobiles. Some of the American manufacturers are flooding the Spanish dealers with letters in which they ask the dealers to accept agencies on a cash-with-the-order-against-shipping-documents basis, and suggesting to the dealers that they should agree to sell a certain number of machines per month, by the year. All of this is a useless waste of stationery and postage.

Holidays are the gala days for automobiles in Madrid. A great line of machines loaded down with the laughing members of out-of-door-loving families may be seen winding along the road going to the Guadarrama Mountain Range, which is thirty miles from the city, the outing parties being bound for the woods where the gay folks go in for picnicking. The most popular automobiles are the landaulet, the coupé and the limousine built for five, the runabout having yet to assert itself.

Calendar of Coming Events

Handy List of Future Competitive Fixtures

Race Meets, Runs, Hill-Climbs, Etc.

June 6.....New York City, Reliability Contest for Electrics on Long Island.
June 7.....New York City, Orphans' Day.
June 8.....Algonquin Hill Climb, Chicago Motor Club.
June 10.....Philadelphia, Track Races, Philadelphia Auto Trade Association.
June 10.....West Haven, Conn., Shingle Hill Climb, Automobile Club of New Haven and Yale Automobile Club.
June 10.....Philadelphia, Sociability Run for Electrics, Quaker City Motor Club.
June 10-11.....Chicago, Ill. (Hawthorne), Track Races.
June 14.....Buffalo, N. Y., Orphans' Day, Automobile Club of Buffalo.
June 15-16.....Chicago, Ill., Fourth Annual Inter-Club Run, Chicago Automobile Club and Chicago Athletic Club.
June, 15, 16, 17....Dayton, O., Midsummer Meeting Society of Automobile Engineers.
June 15-20.....Endurance Run, Cañon City, Col., to Hutchison, Kan.
June 16-17.....Milwaukee, Wis., Track Races, Fair Grounds (Circuit).
June 16.....Washington, D. C., Motor Car Carnival, Washington Automobile Club.
June 17.....Ossining, N. Y., Hill Climb, Upper Westchester Auto Club.
June 17.....Portland, Me., Hill Climb, Maine Automobile Association.
June 19.....Des Moines, Iowa, Annual Tour, Hyperion Field and Motor Club.
June 20-23.....Detroit, Mich., Summer Meeting National Gas and Gasoline Engine Trades Association.
June 21-29.....Glidden Tour, Washington, D. C., to Ottawa, Canada.
June 20.....St. Louis, Mo., Reliability Run, Auto Club of St. Louis.
June 24.....New York, Track Races, Brighton Beach (Circuit).
June .....Denver, Col., Reliability Run, Denver Motor Club.
June .....Norristown, Pa., Hill Climb, Norristown Auto Club.
June .....Oklahoma, Reliability Run, Oklahoma Auto Association.
July 1.....Riverhead, L. I., Road Race (Circuit).
July 1-3.....Motor Contest Association's Catskill Run and Hill Climb.
July 4.....Detroit, Annual Track Meet, Wolverine Automobile Club.
July 4.....Bakersfield, Cal., Road Race, Kern County Merchants' Association.
July 4.....Denver, Col., Track Races, Denver Motor Club.
July 4.....Port Jefferson, N. Y., Hill Climb (Circuit).
July 4.....Worcester, Mass., Hill Climb (Circuit).
July 5-22.....Winnipeg, Man., Fourth Canadian Competition for Agricultural Motors.
July 7.....Taylor, Tex., Track Races, Taylor Auto Club.
July 8 or 15.....Philadelphia, Track Races, Belmont Park, Norristown Auto Club.
July 12.....Indianapolis, Indiana Four-State Tour, Indianapolis Auto Trade Association.
July 14.....Philadelphia, Commercial Reliability Run, Quaker City Motor Club.
July 17-19.....Cleveland, O., Three-Day Reliability Run of the Cleveland News.
July 17-22.....Wisconsin Reliability Run, Wisconsin State Automobile Association.
July 29.....Philadelphia, Track Races, Belmont Park (Circuit).
July .....Amarillo, Tex., Track Races, Panhandle Auto Trade Association.
Aug. 1.....Chicago, Ill., Commercial Reliability Run, Chicago *Evening American*.
Aug. 12.....Detroit, Track Races, Fair Grounds (Circuit).
Aug. 12.....Philadelphia, Reliability Run, Quaker City Motor Club.
Aug. 25-26.....Elgin, Ill., National Stock Chassis Road Race, Chicago Motor Club (Circuit).
Aug. .....Denver, Col., Hill Climb, Denver Motor Club.
Sept. 1.....Chicago, Ill., Commercial Reliability Run, Chicago Motor Club.
Sept. 1.....Oklahoma, Reliability Run, *Daily Oklahoman*.
Sept. 4.....Denver, Col., Track Races, Denver Motor Club.
Sept. 4.....Indianapolis, Track Races, Motor Speedway (Circuit).
Sept. 7-8.....Philadelphia, Track Races, Philadelphia Auto Trade Association.
Sept. 8.....St. Paul, Minn, Track Races, State Fair (Circuit).
Sept. 12-13.....Grand Rapids, Mich., Track Races, Michigan State Auto Association.
Sept. 15.....Knoxville, Tenn., Track Races, Appalachian Exposition.
Sept. 16.....Syracuse, N. Y., Track Races, State Fair (Circuit).
Sept. 23.....Lowell, Mass., Road Race (Circuit).
Oct. 3-7.....Danbury, Conn., Track Races, Danbury Agricultural Society.
Oct. 7.....Philadelphia, Fairmount Park Road Race (Circuit).
Oct. 9-13.....Chicago, Ill., Thousand-Mile Reliability Run, Chicago Motor Club.
Oct. 16-18.....Harrisburg, Pa., Reliability Run, Motor Club of Harrisburg.
Oct. 19-21.....Atlanta, Ga., Track Races, Speedway (Circuit).
Oct. .....Denver, Col., Track Races, Denver Motor Club.
Nov. 1.....Waco, Tex., Track Races, Waco Auto Club.
Nov. 2-4.....Philadelphia, Reliability Run, Quaker City Motor Club.
Nov. 3.....Savannah, Ga., Light Car Road Race (Circuit).
Nov. 7-10.....Los Angeles-Phoenix Road Race, Maricopa Auto Club.
Nov. 9-11.....San Antonio, Tex., Track Races, San Antonio Auto Club.
Nov. 10.....Phoenix, Ariz., Track Races, Maricopa Auto Club.
Nov. 30-Dec. 2, 3...Los Angeles, Cal., Track Races, Motordrome.
Dec. 25-26.....Los Angeles, Cal., Track Races, Motordrome.

Foreign Fixtures

June 1.....Bucharest, Roumania, Speed Trials.
June 4.....Trieste, Austria, Hill-Climb.
June 18.....Boulogne, France, Voiturette and Light-Car Road Races.
June 25.....French Light Car Race, Coupe des Voiturettes, Boulogne-sur-Mer course.
June 25-July 2.....International Reliability Tour, Danish Automobile Club.
July 5 (to 20).....Start of the Prince Henry Tour from Hamburg, Germany.
July 9.....Sarthe Circuit, France, Grand Prix of Automobile Club.
July 13-20.....Ostend, Belgium, Speed Trials.
July 21-24.....Boulogne-sur-Mer, Race Meet.
Aug. 6.....Mont Ventoux, France, Hill Climb.
Sept. 2-11.....Roubaix, France, Agricultural Motor Vehicle Show.
Sept. 9.....Bologna, Italy, Grand Prix of Italy.
Sept. 10-20.....Hungarian Small-Car Trials.
Sept. 16.....Russian Touring Car Competition, St. Petersburg to Sebastopol.
Sept. 17.....Semmering, Austria, Hill-Climb.
Sept. 17.....Start of the Annual Trials Under Auspices of *l'Auto*, France.
Oct. 1.....Gaillon, France, Hill-Climb.

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H. M. SWETLAND, President
A. B. SWETLAND, General Manager
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SYSTEM is the direct road to success. In the working of freight automobiles for the delivery of goods THE AUTOMOBILE this week devotes its leading article to the questions of system, showing how the work may be carried on through all of its ramifications, picking up every detail and coalescing the whole performance, so that success, under such conditions, is assured from the start. Against this plan of operation is the happy-go-lucky idea of the merchant who thinks he will try a truck or two to see how good they are. The merchant who is guided by a rule-of-thumb and the so-called happy thought that leads him up to the experiment, will never know whether or not his investment is good or bad. There is another phase to the incidental way of trying out freight automobiles; if they are placed in the hands of the men who are in charge of the horse-drawn vehicles the idea cannot gain success, due to the fact that the men who will have charge of the operation of the freight automobiles will not only be lacking in skill, but they will harbor the impression that they must make a failure of the freight automobiles, the fear being that they will lose their jobs if horse-drawn vehicles are supplanted by the more modern equipment.

* * *

SPORT is having its day, and the race at Indianapolis represents the banner event of the year from the sport point of view. The Speedway at Indianapolis is the most thoroughly well-contrived place of its kind in the world, and the men who are backing the venture, having placed their money and their energies where racing automobiles are given the fullest opportunity to show their stamina, have done their part in the building up of clean sport. There is a diversity of opinion among the leaders in the automobile business, some of whom seriously question the value to the industry of racing automobiles, it being the case that a racing automobile has little in common with a stock car, but it is not believed that the leaders have discussed this matter on a sufficiently comprehensive basis to bring out all of the attending facts. The rules as formulated by the Contest Board provide for a technical examination accompanied by a statement of the makers of automobiles, all with a view to the proper defining of stock cars. The effort as outlined by the Contest Board is praiseworthy in every respect, but the fact remains that a technical committee cannot tell whether or not the stock cars as defined are exactly like the stock cars that purchasers will get for their money, nor could any technical committee arrive at a definite conclusion without resorting to the use of photomicrographs of the steel used not only in the stock cars that go to purchasers, but in the stock cars, so called, that are used in racing, thus making a precise and sure comparison of the steels used in these two divisions of stock cars.

* * *

ANOTHER way to settle upon the stock car status of automobiles that are used in stock car events is to send the Technical Committee of the Contest Board to the plants of the makers and let them pick out automobiles at random as they are completed and standing on the floor ready to be delivered to purchasers. This plan would in no wise interfere with the preparation of these stock cars for racing, nor can there be any possible objection to the stripping of the cars and the doing of such other things as are allowed by the rules, so that the automobiles entered in a race will be advantageously placed. The real thing to guard against is the use of high-priced alloy steel in the cars that are entered in racing events, if this type of steel is not used in the automobiles that purchasers are apt to put their money into. This possibility would be guarded against by the simple expedient of letting the Technical Committee pick the automobiles that are to be used for racing out of the stock that purchasers draw from. The rules provide that there shall be a certain number of finished cars of the same model behind any automobile that is entered in a stock event, so that it would be no hardship on a maker were he required to permit the Technical Committee to take from actual stock the automobiles that are said to be stock models.

* * *

INCREASING activity in motor designing marks the plans of the companies in many quarters, and this point is no more fittingly illustrated than in calling attention to the new rotary valve motor that has just been brought to the surface at Detroit. That history repeats itself is also a point that this new motor shows, the only difference being that the broad idea as it was used in stationary work a matter of twenty years ago fell to the ground, due to failure on the part of the men who were responsible for the task, and to the fact that good castings for motor cylinders were not then to be had.

Savannah Gets Grand Prize

Big Officials From Savannah Confer With Vanderbilt

On Monday night the members of the Motor Cups Holding Company held a New York meeting as a result of which it was agreed to not only hold this year's Grand Prize Race over the same course as in 1910, *but to use the Savannah course also in the holding of the Vanderbilt Cup race. The Motor Cups Holding Company was represented by William K. Vanderbilt, Jr., Henry Sanderson, Dave Hennen Morris and H. B. Anderson, while the following citizens of Savannah took care of the interest of that city: Mayor George W. Tiedemann, Harvey Granger, president Savannah Automobile Club; Frank Battey, Judge O. T. Bacon, A. B. Moore and Arthur Solomon.*

IN view of the relation of the Automobile Club of America to international events, and under the agreement of the international clubs with the controlling body, it appears to be the case that the Savannah Automobile Club in arranging for the holding of the Grand Prix and the Vanderbilt Cup race at Savannah, found it opportune to confer with Mr. Vanderbilt and the officials of the Automobile Club of America, for which purpose A. W. Solomon, secretary, Harvey Granger, chairman of the contest committee, and Frank C. Batty, president of the Savannah Club, were in New York, and such progress has been made during the conference as would lend substance to the story that is being circulated to the effect that the "Big Classic" and its companion events will be held at Savannah, thus leaving the Vanderbilt course on Long Island out of the consideration altogether. For the purpose of convincing the officials here that the Savannah course would be fully protected, high county officials came well prepared to New York and assured the committee of the A. C. A. that military protection will be at hand if the sanction goes to Savannah. Mayor Tiedeman of Savannah was in New York attending the conferences, and his assurance of protection and his weight behind the plan undoubtedly had a marked effect upon the attitude of the officials of the A. C. A. in the matter.

The best assurance of the ability of the Savannah Automobile Club to protect spectators and properly control the details of the events lies in the coming of Judge Moore, who is county commissioner, to New York, he having been present at the conference with the Motor Cups Holding Company. It is settled that the Grand Prize, which will be run under the sanction of the A. C. A., will go to Savannah. In relation to the Vanderbilt, however, since this event is under the control of the A. A. A., there are formalities to be concluded before it can be said with certainty that the Vanderbilt Cup will be run at the same time and place. The idea that is being put forward is to hold the two events on succeeding days, the Grand Prix to be handled by the officials of the A. C. A., who will surrender their position during the holding of the Vanderbilt Cup event, the latter to be run off under the direction of the Contest Board of the A. A. A.

The distinguished party of Savannahans, including the officials, Mayor Tiedeman and Judge Moore, having concluded negotiations with the officials of the Motor Cups Holding Company, went back to Savannah on the night of May 30, it being the case that Chairman Butler of the Contest Board is at Indianapolis, Ind., in charge of the 500-mile Sweepstakes, and it is the purpose of the Savannah officials to arrange the general details of the big Savannah event, with the expectation that they will come back to New York at a date to be fixed in the near future for the purpose of conferring with the A. A. A. Contest Board relative to the sanction for the Vanderbilt Cup race.

Among automobilists in Savannah, the news is already available telling of the holding of these two events there, and the whole automobile fraternity is agog with interest; moreover, as high officials in New York have expressed an opinion, Savannah is the ideal place for the holding of these big races, due to the fact that the state and the city, with the co-operation of the county officials, are not only willing, but able to give the type of protection that seems to be necessary for the safe handling of these affairs.

S. A. E. to Discuss Standards

Comprehensive plans of reporting steel specifications will be presented to the engineering body when it assembles at Dayton. Ball bearings, also, in their relation to uniformity of sizes will be considered at the annual convention along with a mass of reports of sub-division committees on standardization.

At the last meeting of the Society of Automobiles Engineers several reports were submitted by the divisions or sub-committees of the Standard Committee. It was pointed out that the proposed specifications on iron and steel were tentative and suggestive and represented the work of the committee so far as it had been performed to date.

In writing the specifications a system of reporting the elements that make up steel was adopted. These ran: 1, carbon; 2, manganese; 3, silicon; 4, phosphorus; 5, sulphur, etc. The idea was that all chemical laboratories would have their slips made in the same way, so that the engineers would get used to looking for the same element in the same place. All steels contain the elements above named.

The attempt was made to draw up the iron and steel specifications practically for materials that can be bought for a reasonable price. There are finer materials and there are poorer materials than were specified in the report, but the attitude of the committee was that if the metals specified were properly heat-treated and properly applied in the automobile good results would be obtained. It was pointed out in the society meeting that higher grades of steel and certain alternate grades sold on the market and known to be satisfactory should be included in the specifications. It is fair to assume that they will be so included in the next report of the iron and steel division.

Samples of steel can be obtained from a steel company and tested by the automobile manufacturer, who can then contract that the steel maker will furnish the same physical characteristics thereafter for the stated purpose. A growing number of automobile engineers are inclined to hold that putting the responsibility for producing the steel required on the steel manufacturer would assure that the factor of safety in automobiles would be maintained at the standard which the peculiar conditions called for in the work demanded. That in this case the specified chemical composition would have to be followed very closely to produce their result; also that if the question of supplying the necessary heat treatment of the steel was put up, better results would be obtained.

There was considerable discussion on the subject of tolerance in the measurements of ball bearings, a matter in which there is great diversity of practice among the bearing manufacturers.

It is likely that the society will have some authoritative measurements made of commercial bearings.

500-Mile Sweepstakes Run Off

Marmon Home with the Bacon—Lozier

Fig. 1—The entire field of forty cars coming down to the line in position behind the pacemaker

Fig. 2—View of the straightaway above wire

INDIANAPOLIS, May 30.—In the greatest automobile race ever run so far in the history of the industry, the Marmon entry No. 32 won the 500-mile International Sweepstakes to-day from the greatest field that ever faced a starter. The car was driven by Ray Harroun, whose retirement from automobile racing has been periodically announced. The Marmon led for more than 300 miles, but at no time was far in advance of its rivals.

Lozier, No. 33, driven by Ralph Mulford, was a good second, and but for some slow and clumsy work at the pits might have given the winner a little stronger argument. Third place was taken by a Fiat car, driven by David L. Bruce-Brown. A mechanical mishap in the final round prevented a better showing.

The specially-built 200 h. p. Mercedes, which is said to have cost Spencer Wishart $63,000, finished in fourth position, driven by Mr. Wishart. In fifth place came Simplex car No. 2, driven by De Palma, while in order following were National 20 (Merz), Amplex 12 (Turner), Jackson 25 (Cobe), Knox (Belcher) and Mercer (Hughes).

When the finishing flag had been waved for these there were still fourteen other contestants on the track.

It was a glorious day, cool and varied by alternate sunshine and clouds. There was sufficient breeze to make even Indianapolis bearable, and almost 100,000 persons paid admission to the Speedway to witness the contest. It was a day of thrills, in which the climax came just before the leading car passed the half-way mark.

For one tense instant 80,000 persons breathed groans of anguish as four cars piled themselves up in a tangled heap at the south end of the pits.

It was a moment pregnant with possibilities, and it marked the birth of a new hero. Case car No. 8 broke the steering knuckle passing the stand on its 87th round, and the car careened against the retaining wall in front of the judges' stand. Wobbling uncertainly, the car started out to mid-track, where with a lurch it threw L. Anderson, the mechanic, sideways from his seat. Running like a watch and well up with the leaders was the Westcott car No. 7, driven by Harry Knight. He was too close to the prostrate Anderson to avoid some sort of a disaster, and he chose to let himself and his car bear the brunt of it. With a powerful whirl of his steering wheel, Knight headed his car to the left and darted straight into the side of Apperson No. 35,

at the Indianapolis Speedway

is a Close Second—Fiat on the Rind

Fig. 3—How guards prevented bridge accidents

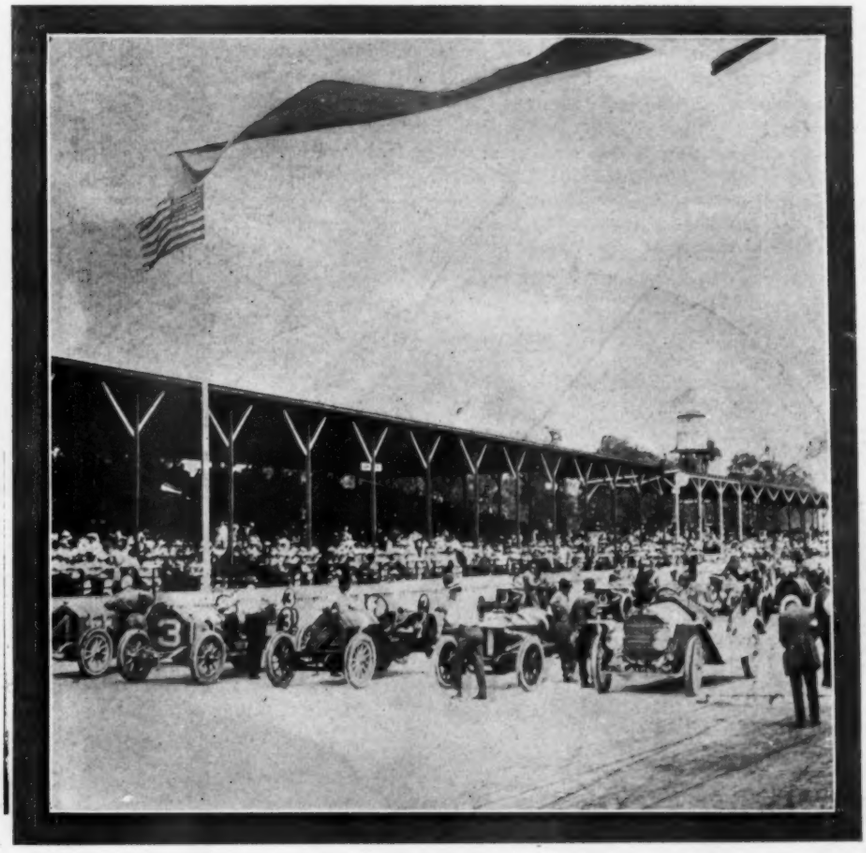


Fig. 4—Ready for the start of the race—the forty contestants lined up in eight platoons

which was undergoing tire changes. There was a terrific crash, which was witnessed by all the thousands ranged along the straightway. The Apperson turned over, throwing Herbert Lytle twenty-five feet and injuring his mechanic. The injured Westcott car turned end for end in the air and dropped upon Fiat 18, which was standing south of the pits having a new drag rod installed. The impact was so great that it moved the structure of the pits like the bending of a bow.

For a moment it looked as if the race was finished right there, and the officials strove desperately to check the contesting cars.

But the work of the Westcott had cleared the track of obstacles, and in another moment the signal to go ahead was given. Marvelous it may seem, nobody was seriously injured in this smash. The Westcott car would certainly have been among the leaders at the end had it maintained its excellent running. In practically 240 miles it had changed but two tires.

The start of the race was one of the most interesting things about it. The field of forty was lined up in ranks of five, between which 100-foot intervals were allowed. On the left of the front rank was Carl G. Fisher, President of the Speedway Company, in his Stoddard-Dayton roadster, acting as pacemaker. When the word was given the cars moved out, keeping almost alignment at a rate said to be 40 miles an hour. All around the big oval the ranks swept in platoon formation until they reached the head of the stretch. There they closed distance, and before reaching the starting point each driver prepared himself to take the position he wished in the opening round.

At the wire Mr. Fisher pulled out to the left, and the starting flag and bomb sent the field away on its long grind. National car No. 4 showed first in the lead, maintaining the pace for about three laps. The Mercedes entry then took up the running and stayed out in front for eight laps. Knox No. 15, which, by the way made the best showing of any Knox car so far in the supreme tests of speed and endurance, displaced the Mercedes and led at the end of thirty miles. Fiat No. 28, driven by Bruce-Brown, took up the running at this point, and with the exception of a momentary faltering which allowed National No. 4 and then Simplex No. 2 to lead for a little while, this car made the pace until half the journey was over. At one time No. 28 had a lead of 7½ miles. Reaching the half-way mark, the long, narrow, six-cylinder Marmon, guided by the veteran Harroun, glided into the lead and from there to the coveted point at which the magpie

flag announced the winner the sturdy Wasp stayed out in front.

It was a fierce struggle all the way in, and the winner did its work so silently that few in the stands realized what was happening until it happened. Sitting all alone in the narrow cockpit of the Wasp and trusting to an adjustable mirror placed just in front of his eyes to warn him of the approach of any of his rivals from the rear, Harroun drove a masterly race. He was assisted in his work by Cyrus Patschke, who took the wheel for about 100 miles when the Marmon was working its way through to the front. Patschke also assisted in driving the four-cylinder Marmon No. 31 when Dawson required relief. The winner experienced no mechanical difficulty, and went through with only four tire changes. The first prize and the prizes for which the car was eligible among the list offered by the accessory makers amounted to $14,250.

The Lozier, which came second, was always prominent. Fourth place was as far back as the car was at any time after the ninetieth mile. In the last fifty miles Mulford kept shooting it along at better than 80 miles an hour, which naturally caused him to call at the pits for new tires rather frequently. Tire changes at the Lozier pit were not as fast as those enjoyed by others of the contestants. The replacement of a wheel proved costly in time to this car.

Fig. 5—The winning Marmon entering upon its last round of the Speedway

Fiat 28 and Mercedes 11, the next two to finish, did their prettiest all the way. The foreign cars ran splendid races, but they were not good enough to win. Neither experienced special mechanical troubles until the mishap to the Fiat in the last round, which was the breaking of the spark lever on the wheel. Simplex No. 2 (De Palma), prominent throughout except for a few rounds while a new wheel was working into condition, was a distant fifth. The showing of the National trio was fair, but car No. 4, which exhibited dazzling speed in the early stages of the race, went out in the 123d round with a broken connecting-rod. No. 21 (Wilcox) did not get into the money, and the only honors captured by the team was sixth place, which fell to No. 20, handled by Merz. Amplex No. 12, driven by Turner, made a creditable showing, finishing in seventh place. More was expected of Turner's colleague, No. 44, than of the car that finished the race, because of the severe accident which nearly put Turner's car out of the running during the practice. No. 44 turned over on the back stretch in the thirteenth round, after losing a loosened tire. This mishap resulted in the only fatality of the day, as Sam Dickson, mechanic, was crushed to death under the car. Greiner, the driver, suffered a broken shoulder and other contusions and bruises. Jackson car No. 25 (Cobe) made a splendid showing and finished well in hand in eighth place. The Knox entry was ninth and the small end of the purse went to Mercer 36 (Hughes). The New Jersey car ran smartly from end to end, but did not have quite enough power to land higher

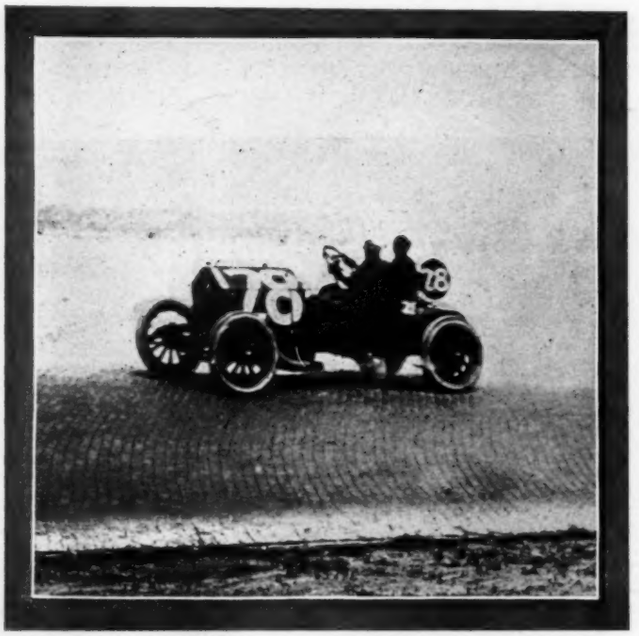


Fig. 6—Fiat, No. 28, which broke its spark lever, but finished third

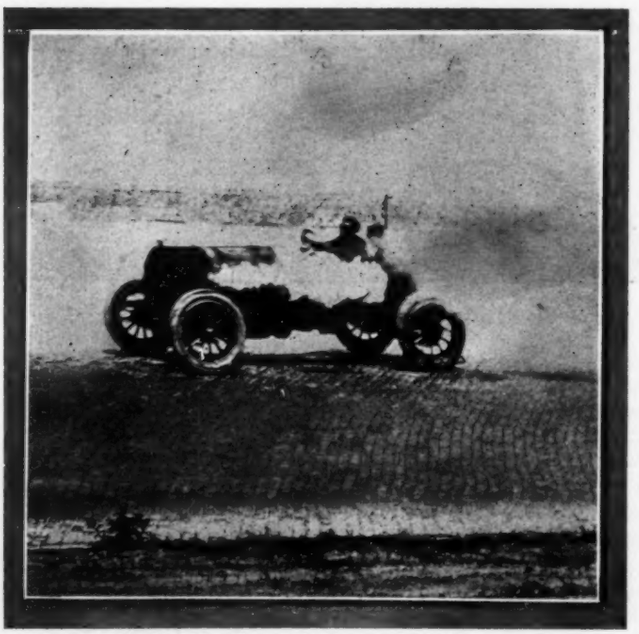


Fig. 7—Mercedes, No. 11, the 200-horsepower monster that failed to win

in the list. The Case trio demonstrated high speed and reliable going qualities, but all three developed trouble with the steering gear, so it was reported.

The Pope-Hartford pair failed to finish. Car No. 5 (Disbrow) lost ten laps through ignition trouble in the early stage of the race and was struck by Lozier No. 34 up the home stretch in the forty-ninth round. Both car No. 5 and No. 34 were put

out of the running by this mishap. Car No. 6 broke a torsion tube in the last half of the race, but was repaired in time to have finished, had it not experienced some trouble with its gears while the relief driver was at the wheel.

The Buick pair did not get very far, dropping out after mechanical difficulties overwhelmed them. The Alco entry, winner of two Vanderbilt cups, negotiated a little over one-quarter

Fig. 8—Simplex, No. 2, always prominent, which took fifth money

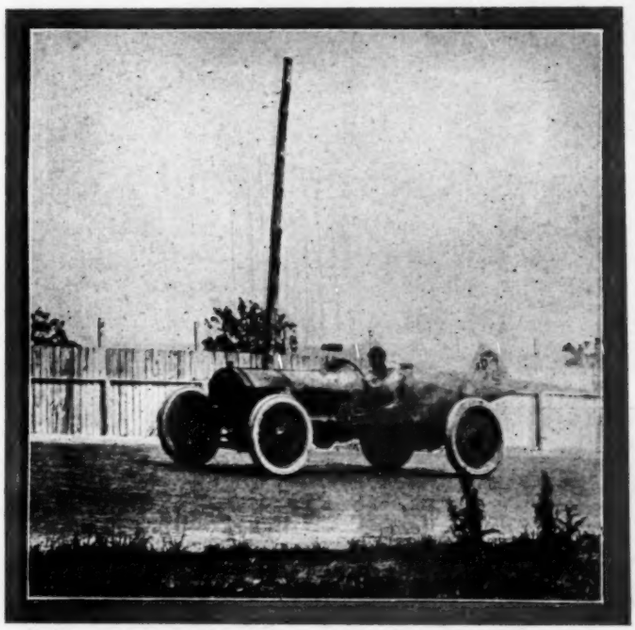


Fig. 9—The "Wasp," No. 32, on the straightaway

of the distance and retired from the race with burnt-out bearings.

The showing of the Jackson trio was satisfactory, despite the tremendous handicap under which they ran. On Sunday a gasoline fire in the garage in which these cars were stored almost destroyed them. The tires were burned off two of them and the insulation on one was badly melted. This probably caused the withdrawal of No. 24, from general debility, in the first quarter of the race. No. 26 also failed to get into the honorable list of finishers, but No. 25 won its spurs after having some mechanical trouble with its steering gear.

The toughest luck of the race fell to the lot of Marmon 31 (Dawson). This car certainly would have beaten the Mercedes giant and perhaps the Fiat 28 if the "jinx" in the form of a broken radiator had not intervened in the final round. Dawson was obliged to stop his car up at the head of the stretch and watch the third and succeeding prize winners dash past him to victory. Not an atom of trouble had been experienced by the car from the start until the radiator sprung a leak.

The Apperson was doing nicely when it was put out by the Westcott in the sensational jam in front of the stand.

Simplex 38 (Beardsley) experienced clutch troubles and made the last few rounds in which it appeared with copper wire rather prominent in its mechanical parts.

The Velie, while never a factor in the race, performed creditably for a car of its size and power.

The showing of the Benz pair was very ordinary. Car 45 (Burman) went through a series of tire troubles that must have proved discouraging. The most spectacular event in which either of the Benz cars took part was when Burman, rounding the first turn, threw his right front shoe. The heavy casing and

Fig. 10—Lozier, No. 33, "beating it" in its final sprint for the place

metal rim whirled out on the track in front of the car, mounted the steep embankment at the south side of the speedway and, striking the 4½-foot retaining wall at the top of the bank, bounded high in the air and fell one hundred feet outside the course. Neither of these cars was in the first ten at the finish.

The cars in the field were not necessarily "stock cars." The only qualifications required of them were that their pistons displaced less than 600 cubic inches and that they weighed more than 2300 pounds. Many of them measured the same as regular stock models put out by their manufacturers, but some were frankly and openly nothing more than special racing cars.

The winner is a peculiar looking automobile. Its lines are very slender. The hood covers an engine having six cylinders, 4½ x 5 inches and measuring 477 cubic inches. Its stern is drawn out to a long sharp point, extending back probably 4 feet from the driver's cock-pit. There is room for only one person in the car, and to this fact possibly may be attributed its freedom from tire troubles and mechanical difficulties. The Lozier car is said to be identical with the 1912 model put out by that factory.

There were three elements of supreme importance in the winning of the race. It was a terrific test of man, mechanism and good luck. The timing device suffered its mishaps, too. About midway of the race the wire broke, but was repaired before the round was finished. Later, however, it snapped again under the continued pounding of the racing cars and was disabled for many laps. The scoring was only partially satisfactory, although there was an occasional variation between the boards. The officials had little to do after the racers had started. In preparing for the event a meeting of drivers and mechanics was held in Tomlinson Hall, which was attended by the whole force. Mayor Bookwalter addressed the drivers and cautioned them to obey the rules. Carl G. Fisher also made a brief address, and the officials of the meet instructed the crews as to their duties. To this fact may be attributed the comparative safety with which the race was run. It scarcely seemed possible to conduct such an event with such a field under such conditions without killing a dozen. The constant passage of forty racing cars around the course caused the first turn to be bathed in oil, and after 300 miles had been run the management caused the lower turn to be sprinkled with sand.

In the first hour the leading car traveled 72½ miles. At the end of the second hour it had gone 150 miles; third hour, 222½ miles; fourth hour, 295 miles; fifth hour, 370 miles; sixth hour, 445 miles. The winner's time was 6 hours, 41 minutes and 8 seconds.

When Ray Harroun made his final dash, winning, and the race was declared closed, the excited throng were in a receptive mood, and the report was circulated of the death of S. P. Dickson, of Chicago, mechanic, who rode with Arthur Greiner, driver, of the Amplex "44." Eye-witnesses are authority for the statement that both rear tires burst at a curve, and Dickson was hurled a great distance against the fence, and from all accounts, his death was instantaneous. The driver, Greiner, had a narrow escape; the automobile was demolished. At the hospital it was learned that Greiner had a fracture of the arm and many contusions besides.

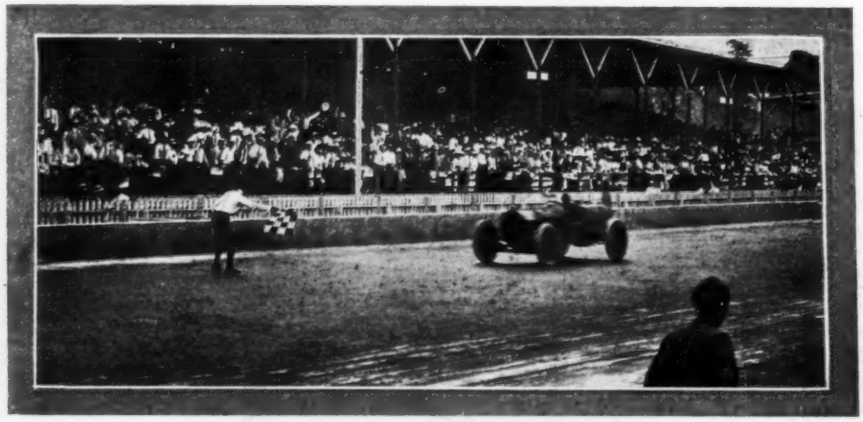
C. L. Anderson, mechanician, and Joe Jagersberger, driver of No. 8 (Case) stopped at the pit for repairs, and having completed the task were getting away, but the spectators were in a position to observe that there was something wrong, and Anderson, as he bent forward in his investigation, fell out of the car; one of the members of the steering gear had been broken. The machines were passing with an interval of two seconds, and the spectators to the last man were given the shock of their lives, but Anderson got away.

Then came the Westcott thundering along at top speed with Harry Knight at the wheel and John Glover, mechanician, sitting tight. Knight saw Anderson in his path, and accordingly clapped on the emergency brake, resulting in strange pranks on the part of the machine; besides doing a waltz to rickety time it leaped up in the air and came down on its back. In the melee, while Herbert Lytle and two mechanicians were busying themselves on their Apperson car, the mad Westcott automobile grap-

THE WINNERS IN THE GREAT 500-MILE INTE

No.	Car.	Driver.	Tires.	Magneto.
32	Marmon	Ray Harroun	Firestone	Remy
33	Lozier	Ralph Mulford	Michelin	Bosch
28	Fiat	D. Bruce-Brown	"	"
11	Mercedes	Spencer Wishart	"	"
31	Marmon	Joe Dawson	Firestone	"
2	Simplex	Ralph De Palma	Michelin	"
20	National	Chas. Merz	"	Remy
12	Amplex	W. H. Turner	"	Bosch
15	Knox	Fred Belcher	Fisk	"
25	Jackson	Harry Cobe	Michelin	Splitdorf

Fig. 11—Testing the gasoline for use in the race



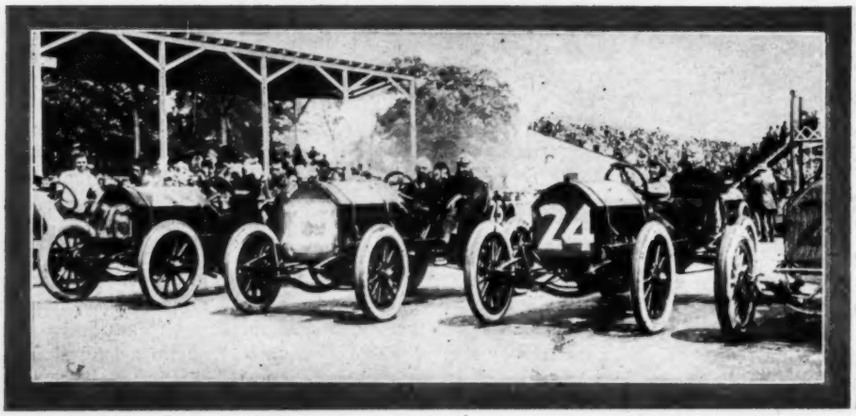


Fig. 12—Scene at the finish when the winning Marmon went under the wire
Fig. 13—The Jackson trio, including the car which captured eighth money

RNATIONAL SWEEPSTAKES AT INDIANAPOLIS.

No. Cyl.	Bore.	Stroke	Pis. Dist.	Time. h.m. s.	Winnings.
6	4¼	5	477	6.42.08	$10,000
4	5⅜	6	544	6.43.51	5,000
4	5	7½	589	6.52.29	3,000
4	5.1	7.1	583	6.52.57	2,000
4	4¼	7	495	6.54.34	1,500
4	5¾	5¾	597	7.02.02	1,000
4	5	5 11/16	447	7.06.20	800
4	5 5/16	5	443	7.15.56	700
6	5	4¾	559	7.19.09	600
4	5	5½	432	7.21.50	500

pled the Apperson and hurled it partly into the Benz pit, which was occupied by four men, but they escaped. Lytle and his mechanician were the most interested spectators for the moment, but beyond slight scratches, they too, got away. In the meantime, the Westcott car fetched up against a post and was wrecked.

Knight and Glover were hurled through the air for a distance of 20 feet, and their present condition is best indicated in a special wire to THE AUTOMOBILE from the Methodist Episcopal Hospital at Indianapolis, as follows:

Indianapolis, May 31, 10:01 A. M.—Knight most seriously injured with a possible fracture of the skull, abrasions, and nervous shock. Glover has a strained back with slight possibilities of internal injuries. House doctor reports have neither of these patients on the danger list.

The other starters in the big race were: Case, driven by Lewis Strang, piston displacement, 284; Inter-State, C. B. Baldwin, 481; National, John Aitken, 589; Pope-Hartford, Louis Disbrow, 390; Pope-Hartford, Frank Fox, 390; Westcott, Harry Knight, 421; Case, Joe Jagersberger, 284; Case, Will Jones, 284; Stutz, Gil Anderson, 390; Buick, Arthur Chevrolet, 594; Buick, Charles Basle, 594; Fiat, Edw. Hearne, 487; Alco, Harry Grant, 580; National, Howard Wilcox, 589; McFarlan, Bert Adams, 377; Jackson, Fred Ellis, 355; Jackson, Jack Tower, 355; Cutting, Ernest Delaney, 390; Firestone-Columbus, Lee Frayer, 432; Marmon, Joe Dawson, 495; Lozier, Teddy Tetzlaff, 544; Apperson, Herbert Lytle, 546; Mercer, Charley Bigelow, 300; Simplex, Ralph Beardsley, 597; Fiat, Caleb Bragg, 487; Velie, Howard Hall, 334; Cole, Wm. Endicott, 471; Amplex, Walter Jones, 443; Benz, Robt. Burman, 520; Benz, Wm. Knipper, 444.

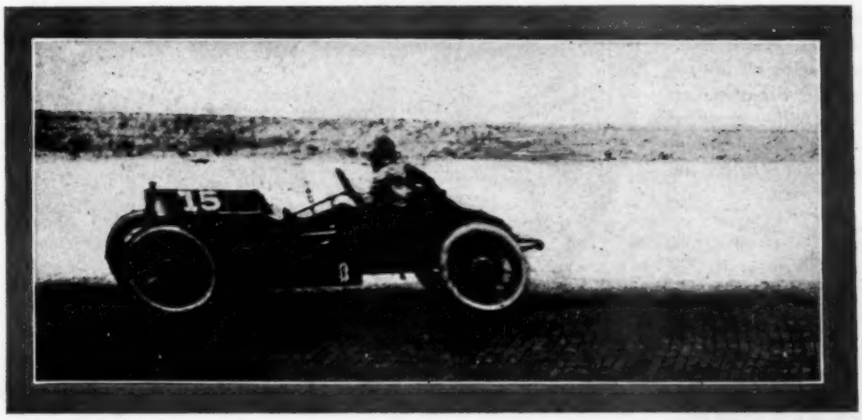
Timing of 500-Mile Sweepstakes May Be Mixed

Considerable doubt is being expressed among the automobile fraternity as to the accuracy of any times that may be given out as having been made at the 500-mile International Sweepstakes Race at Indianapolis. It is known that the wire from which the wheels of the racing cars sent the recording impulses to the automatic printing machine in the stand was broken at least twice during the course of the race.

During the periods when the machine was out of commission the work of timing and scoring the cars had to be based upon the timing officers' personal efforts. The first break occurred early in the race and the officials announced shortly afterward that it had been fixed and that only half a lap had been lost.

Later in the day, however, the continued impact of the racing machines caused the wire to break again and for an hour the timing had to be "done by hand."

Thus it was necessary to supply by human means the service of an automatic machine at least twice during the race and for those two periods, naturally there is no tape from which to check the scores. The score by laps was a sort of symposium in which many willing hands and young heads had a part. For instance, during the greater part of an hour the Lozier car No. 33 was carried on the press board as one lap ahead of the winning



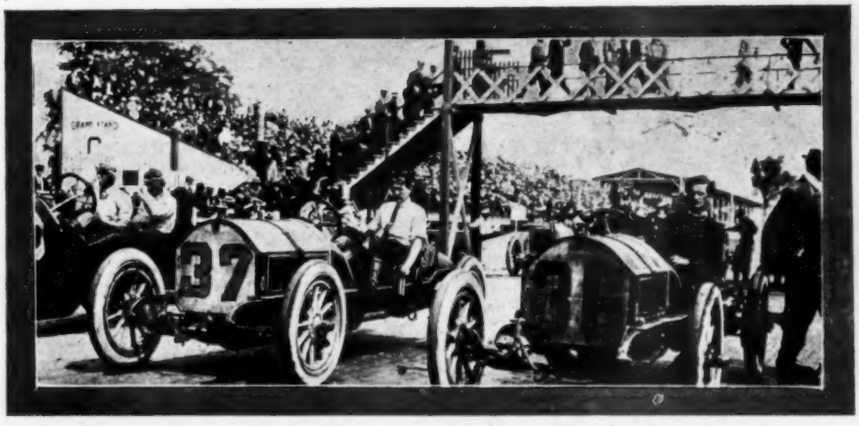


Fig. 14—Knox, No. 15, making a gallant run for the wire
Fig. 15—Mercer, No. 36, which made a fine showing among the small cars

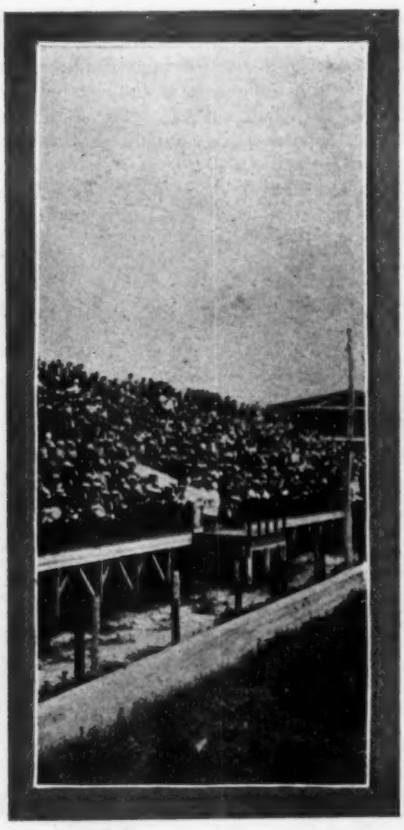


Fig. 16—Crowds fascinated by smash-up in front of the pits

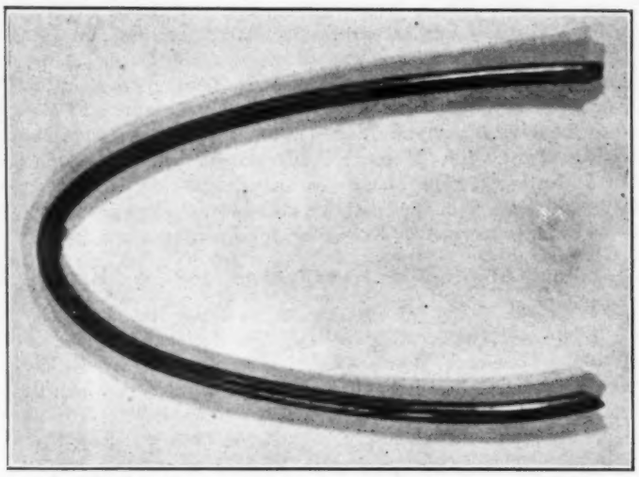


Fig. 17—Piece of the "trip-wire," showing how it broke during the race, putting the electrical timing apparatus out of commission for a time and interfering seriously with the accuracy of the automatic record

Marmon, while the official slips showed that the Marmon was bowling along in front all that time. It was during at least a large part of this stage of the race that the automatic machine was out of commission. In explanation it was stated that the slips were correct and the board was at fault.

One of the representatives of THE AUTOMOBILE called the attention of the officials to an error in the slips earlier in the race when these cards showed that Lozier car 34 was in third position at a time when the score board told of at least a dozen cars that were ahead of Tetzlaff's. No. 34 was considerably behind at the time noted and the officials made the correction.

Delay in Announcing the Result

INDIANAPOLIS, 5:50 P. M., May 31—"Special Telegram to THE AUTOMOBILE—Official score not yet computed."

Delay after delay has been experienced in the issuing of the announcement of the official score of the 500-Mile Sweepstakes. Among the difficulties attending the digesting of the mass of figures involved, not the least is the failure of the electrical timing apparatus to maintain proper working order during the running off of the race. THE AUTOMOBILE gives here a halftone reproduction of a piece of the "trip-wire," showing how it parted during the race, thus placing out of commission the timing equipment, making it necessary to resort to personal methods of timing. It will be understood that the making up of the official score would be a relatively simple undertaking were it possible to rely upon the record. As the matter stands it is a serious question as to whether or not the official score will be out to-night; moreover, there is reason to doubt the accuracy of any score that may be patched up in view of the failure of the electrical timing apparatus at a critical moment. It is presumed that the "Contest Board" will put its stamp of approcal upon some sort of a score, but it will come too late to gain admittance to the columns of THE AUTOMOBILE as it goes to press.

INDIANAPOLIS, 10:05 P. M., May 31—Special telegram to THE AUTOMOBILE—Committee still deliberating. Pardington stated to the representative of THE AUTOMOBILE that he hoped to be able to give out information about 9 o'clock. The wire went on to state: "Do not print results as at first given without another wire of confirmation—there does not seem to be any doubt about Harroun winning.

INDIANAPOLIS, IND., June 1, 1 A. M. (Special to THE AUTOMOBILE)—Dictaphones were in use to register the number of cars as they passed the judges' stand. An operator called the numbers to the members of the timing committee. The officials have just sent for these records and had to fetch the manager of the local branch of the Columbia Phonograph Company, Thomas Devine, to help them unravel the tangle into which affairs have been precipitated. No report on score to-night.

A. Taylor in a Brush, winner of Gregory cup for best mileage, Chicago fuel test

W. Findeisen, in Hupmobile, second in Chicago fuel test

Chicago Motor Club's Fuel Economy Test

Single-cylinder Brush wins the Charles E. Gregory Cup with a rating of 35.2 miles to the gallon. Two other cars exceeded 30 miles to the gallon, the Hupmobile registering 33.9 miles and the Ford 33.6 miles. In the formula division the Moline won in the touring car class and the Grout in the roadster division.

CHICAGO, May 26—The annual fuel economy test of the Chicago Motor Club, which was held yesterday, stands out on the calendar as something out of the ordinary. It was a most

successful affair, attracting twenty-three starters, of which number all but one finished. The run went to Milwaukee and back, a distance of 192 miles officially, but really several miles more because of the pilot getting off the route a couple of times.

So far as straight consumption is concerned, three of the cars did better than 30 miles to the gallon, and the winner of the Charles E. Gregory cup, a single-cylinder Brush, landed the trophy with a rating of 35.2 miles to the gallon, the cup going to the car making the journey on the least quantity of gasoline. This was put up for any car regardless of class and provoked a pretty contest among the Brush, Hupmobile and Ford, there being only 33 ounces' difference between first and third. The

W. J. Boone, in Moline, winner of touring car class under formula

Hupmobile's mark was 33.9 miles to the gallon, while the Van Sicklen Ford registered 33.6.

The entire contest, however, was built around the formula class, the handicap event which heretofore has been the only one carded. This year the club tried something new in the way of a development class, which was put on in order that manufacturers of carbureters might get a chance to make official tests of their devices. An eleventh-hour decision was to put on a free-for-all non-stock class in which only straight consumption figured.

As results turned out, the formula division winners were the Moline in the touring car class and the Grout in the roadster division. The results were reached by means of the formula which divides the weight of the car with passenger load by the quantity of gasoline consumed as expressed in half ounces. Nine of the twenty-three cars ran in this division. In the touring car class the Moline had hard work beating the big Cunningham, winner of the fuel economy trophy in the 1,000-mile reliability last fall, which weighed 5,390 pounds and which was beaten only .02 in the percentage column. The Moline averaged 19.3 miles to the gallon and the Cunningham 12.8. The latter showed consistency in that this rating was just about what it did in the 1,000-mile run. The second Moline, running in the roadster class, turned in a card which showed 19.2 miles to the gallon, just .1 less than its larger mate.

The Grout did remarkably well in the roadster class. Carrying a weight of 4,030 pounds it averaged 18.5 miles to the gallon, and had quite a margin over the Moline in the percentage column.

The demonstration class proved one of the features of the contest and undoubtedly will be retained in the future. It proved a boon indeed for those carbureter manufacturers whose devices

Chas. Rayfield in Chalmers car which used kerosene as a fuel

are not stock on certain cars who desire to ascertain officially just what kind of a showing they can make. This let in four makes of carbureters, the Vortex, Rayfield, Barry Iver and Toledo-Petre. No prizes were given in this and there was no attempt made to evolve any winners.

The results, however, were interesting. A Corbin roadster scaling 3,310 pounds and fitted with a Vortex vaporizer turned in a card which shows it ran the 192 miles at an average of 27.4 miles to the gallon. It is claimed by the owner of the Corbin, John F. Palmer, that in a boulevard trial he got 44.7 miles to the gallon. The Findeisen & Kropf Mfg. Co., of Chicago, maker of the Rayfield carbureter, had two entries in this class and another in the free-for-all. It turned a trump by sending out a Chalmers roadster which used kerosene as a fuel and averaged 14.8 miles to the gallon. Its other entry was a big Rambler weighing 4,760 pounds, which did well with a rating of 15.2 miles to the gallon. The third Rayfield car was the little Hupmobile in the free-for-all class, which ran the single-cylinder Brush close with 33.9 miles to the gallon.

Following is a résumé of the results of the test:

Stock Car, Class 1, Touring Cars, Formula Division

No.	Car.	Driver	Fuel in ounces.	Wght.	Percent.	Miles per gal.
7	Moline	Boone	1,272	3,600	2.82	19.3
9	Cunningham	Emery	1,920	5,390	2.80	12.8
8	Staver	Knudsen	1,466	3,690	2.51	16.6
6	Halladay	Johnson	1,836	3,980	2.16	13.4

Stock Cars, Class 2, Roadsters, Formula Division

5	Grout	Halbert	1,327	4,030	3.003	18.5
1	Moline	Salisbury	1,280	3,500	2.73	19.2
4	Midland	Pope	1,523	3,650	2.39	16.1
3	Falcar	Pearce	1,752	3,950	2.25	14.0
2	Warren-Detroit	Morehart	1,558	3,030	1.94	15.8

Development Class, Non-Stock

	Car.	Carbureter.	Driver.	Fuel Consumption.	Wgt.	Miles per gal.
14	Corbin	Vortex	Bird	7 gal.	3310	27.4
11	Overland	Toledo-Petre	Bartholomew	9 gal. 6¾ oz.	3540	21.2
15	Rambler	Rayfield	Garner	12 gal. 54 oz.	4760	15.4
10	Oldsmobile	Barry Iver	Percival	12 gal. 86 oz.	4470	15.2
12	Chalmers	Rayfield (kerosene)		13 gal.	3670	14.8

Free-for-All, Non-Stock

	Car.	Driver.	Fuel consumption.	Miles per gal.
21	Brush	Taylor	5 gal. 59 oz.	35.2
19	Hupmobile	Findeisen	5 gal. 84¾ oz.	33.9
16	Ford	Van Sicklen	5 gal. 92 oz.	33.6
17	Ford	Hay	7 gal. 32 oz.	26.5
22	Cameron	Gordon	7 gal. 64 oz.	25.6
23	Buick	Hall	13 gal. 56 oz.	14.3
18	Ford*	Lanahan	13 gal. 101½ oz.	13.9

*No. 18 had leaky gasoline tank.

The Week in Detroit

A round of the factories there discloses an optimistic feeling regarding the future of the automobile business. There is no longer a tendency to over-produce, the energies of the factory organizations being devoted almost solely to refinement rather than an increase of production. The second-hand car problem is being carefully considered, and the near future may witness some drastic action toward its solution.

DETROIT, May 29—Activity in automobile manufacturing and cognate industries is everywhere apparent. New models are putting in an appearance in the streets, and rumors of new models are filling the air. Additions to factories are going up on every hand, and new establishments are being planned. All in all, the prospects for an entirely satisfactory 1912 season in this center of automobile building are excellent.

The new season's models will be much on the lines of last year's cars with improvements. Some cars are adding extra equipment for the same price. Self-starters and power tire pumps will form part of the equipment on some of the new models. One maker of four-cylinder cars will add a six-cylinder model to his line.

Benjamin Briscoe, president of United States Motors, says that the prospects for the next year's business are very good indeed. The present output of the concern with which he is identified is 30,000 cars and trucks per annum, and he did not think this would be exceeded next year. The policy of the company was rather conservative. It was not wise to fill all the orders that dealers thought they could take, but rather underestimate than over-produce.

Howard Coffin, designer of the Hudson car, is extremely optimistic as regards the outlook for 1912. No official announcement of the next year's models will be made till the end of June, and the different dealers handling Hudson cars were notified some time ago that it would be impossible for the factory to accept any more contracts for 1911. It is not the intention of the company to make any sweeping changes in the next year's models. After a year's experience with the "33" such modifications will be made as the light of experience has shown to be advisable in order to improve the product. The "33" will be the leader for the coming season, but the present output, which is between 5,000 to 6,000 cars, will be materially increased.

Titan taxicab, a new type of cab introduced by the Central Motor Company, which will greatly reduce taxi fares. Costs $850 and runs three miles at the usual cost of one mile

The Packard Company is getting into its stride with 1912 production and daily new hands are being taken on to cope with the increase of orders. The slight falling off in last year's sales was partly due to two things—one was that some makers had over-produced, which unsettled the market; and the other was that, owing to the dearth of cars in the 1910 season, everything that was buyable was sold. The company is developing much new business in the South, where, according to one of the officials, things are waking up. In the Northwest there should be a good year for the small car owing to the excellent prospects of good crops. In order to cope with the truck situation additional buildings have been found necessary, and with two new buildings available some of the room now used in the manufacture of the trucks will be ceded to the pleasure cars. Among next year's features stands pre-eminently the new six-cylinder car which has been placed on the market this spring. Another departure is the extension of the motor casing toward the rear and the method of enclosing the clutch mechanism, doing away entirely with aprons and pans. Other small changes have been made in the "30" model, but of such a nature that the parts of older cars are interchangeable with the new parts. This greatly facilitates the spare part problem.

In order to meet the demand of the E. M. F. "30" and the Flanders "20" the E. M. F. Company will be compelled to increase the floor space in the main factory by taking in some as yet unutilized ground as well as adding two stories to two of the existing buildings. It is the intention of the company next year to increase the output, which now averages close to 100 cars per day. At the present there are 2,000 dealers handling these cars and by the opening of the season it is expected that this figure will be increased to 2,500. There will be no radical changes in next year's models, but such improvements will be incorporated as will make the car simpler and more compact. Since the addition of the chemical and physical laboratory every piece of steel is tested to ensure its being up to specification. The car demand, according to W. E. Flanders, is increasing all over the country, and there is every indication of a record season ahead.

Very little change will take place in Chalmers cars for the ensuing year. It is the aim of the factory to improve the present product by adding refinements rather than by making sweeping changes. Hugh Chalmers, when asked for his opinion as to the 1912 outlook, said that his company would not increase its production for the coming year, but that instead more attention would be paid to detail, if possible, than heretofore. The company is building approximately 6,000 cars this year, and contemplate doing the same next year. He considered that the buying would be brisk, but that makers should be "conservative." He thought that as the automobile business in this country had passed the critical period it behooved manufacturers to settle down to an even stride, and if anything steady their hands rather than over-produce. Buyers, he said, were becoming more discriminating, and it was no longer the outside paint and glamor that they looked for, but mechanical perfection. The real test of the cars was not the quantity sold but the way they stood up after a few years' service. One of the necessities of the present situation is a good service department attached to the agents' and dealers' selling establishments. His company had arranged for ten such departments in different parts of the country where the buyer would be properly cared for and it would now be possible to obtain parts and replacements in any part of the United States within 24 hours after the receipt of a telegram.

Mr. Chalmers was emphatic in denouncing the methods employed by some dealers in endeavoring to obtain sales by allowing large sums for obsolete and decrepit second-hand cars. In his opinion it was better to lose the sale of a car than to take in trade a car that was not worth the money allowed for it. He thought that this year, despite the large sales, had not been a profitable one for the dealers, due partly to the fact that instead of ascertaining if they were making money on a transaction they were guided more by the number of cars sold.

It is the aim of the King Motor Company to build 250 cars by the end of September. The management sees no reason why any material changes should be made in the car for several years to come. The heads of the concern are of the opinion that the forthcoming season would unquestionably be a good one all round, and from present indications will be an exceptional one in the history of the automobile trade. To the present King models it is proposed to add a fore-door roadster with special provision for taking care of the spare tires.

The size of the present factory where the Everitt "30" is being made has become too small to take care of the manufacture. With the present facilities about three thousand cars are manufactured annually and it is the intention of the directors to continue this amount for the next year. Since the company came into being, two years ago, but one model, the "30," has been manufactured. Next season will see the advent of another model which will be of higher power. The "30" will be continued with such refinements as have been deemed necessary to add for the autoist's comfort.

The addition to the present factory will be built in the near future at the back of the present premises. It will consist of a four-story structure 536 feet long by 68 feet deep. Wm. E. Metzger, secretary and treasurer of the company, is confident of an extraordinarily big season for the automobile business in general during the coming year, as there is a decided wave of prosperity coming over the entire country after the effects of last year's tightness. During the preceding month parts manufacturers have been laying in large stocks of material in order to handle the demands of an increased production generally. The personnel of the administrative force has been increased and road inspectors have been established all over the country to be at the service of Everitt owners. Numerous agencies have been established to handle the 1912 output, which with the addition of the new model is expected to figure about 4,000 cars.

J. W. Drake, president of the Hupp Motor Car Company, was sanguine as to next year's business. The days of fictitious profits are over, he said, and buyers want value for their money. The warning that some makers had in the latter part of 1910 of the effects of over-production was timely and others would profit thereby in building well and not too much. He considers that the business is now on a safe basis, but that some companies were possessed of larger establishments than they required, which meant so much extra overhead expense. He is also of opinion that there are too many dealers who take cars in trade simply to sell a car without looking at the future, but that they would profit by their folly and be more cautious in the future as there is nothing like experience to teach a man. He remarked incidentally that, although the trade had settled down to a firm level, he did not think that automobiles would ever be sold in a large way on the instalment plan.

Hamilton Carhartt, Jr., of the Carhartt Company, is of opinion that the 1912 season will be a good one for the automobile business. There is an increasing demand for the light powerful-motored car, especially in the East, owing to the bad nature of some of the roads. He expects that the production of the factory will be increased for next year and that they will have no difficulty in selling all that they can make. Plans for a new building have been prepared.

New Single-Cylinder Taxicab Will Reduce Fares

A big reduction in taxicab fares has been made possible by the introduction of a new type of taxicab, the first of which has arrived in New York from the Detroit factories of the United States Motor Company. The cab is known as the "Titan," and it embodies European features which have permitted extremely low fares compared to those charged in America.

By the use of especially treated materials and exclusive body construction the weight of the cab has been kept as light as consistent with strength. Complete it only weighs approximately 1,600 pounds.

The Titan was made a two-passenger cab for the good reason that four-passenger loads are not profitable. They require larger, heavier bodies, heavier construction, as well as making tire cost and depreciation unnecessarily high. Most of the four-passenger cabs in use carry only two passengers the greater part of the time and the burden of expense falls on cab operators.

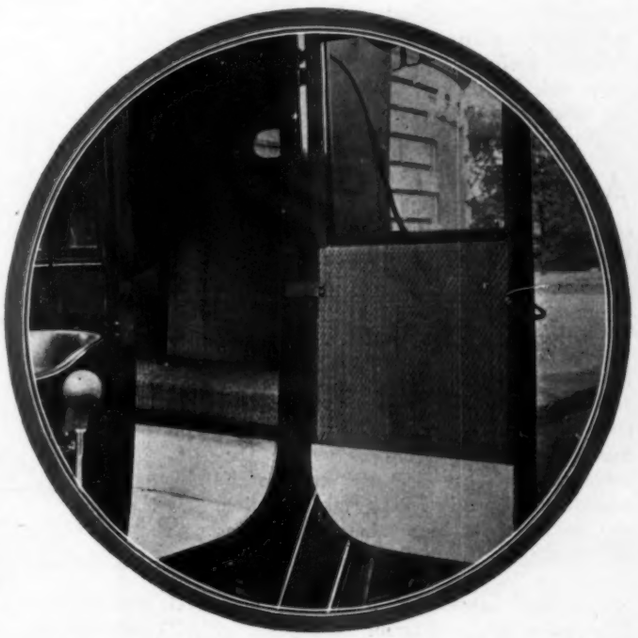
The body is an original creation of the Landaulet type having a single front seat with baggage rack at the driver's right. The seats and trimming are of rattan, which is immune from damage in rough usage, sanitary under all conditions and almost indestructible. The floor boards, scuff plates and toe boards, inside and out, are aluminum matting, which makes for cleanliness, durability and continued good appearance. The lower inside portion of the body is also lined with aluminum.

No frills or delicate ornamentations are provided, and destructive passengers cannot cause damage. Instead of light silk curtains, the Titan has heavy expensive curtains like those used in Pullman sleepers. The glass in the windows is held in position with screw strips—not putty, consequently the cab is not laid up every time a window is broken. Thumb screws and felt keep windows rigid. The speaking tube is not a long cord, to be pulled off, but a stationary one-piece metal tube, which goes through the division post, between the two front windows. A neat top or canopy protects the driver from the sun and adds grace to the general lines of the cab.

A wheelbase of 83 inches permits short turning radius. The motor has one cylinder, 4 x 5 inches, and it embodies a loaded balance gear which eliminates the usual torque vibration of one-cylinder automobiles and the vibration due to reciprocating weight.

The cab is built with coil springs specially designed for the rough usage met in taxicab work. Resiliency and indestructibility are their chief characteristics. Fenders are straight and fine looking. Beaded fenders were discarded because in taxicab work, wherein they are frequently bent, it is impossible to quickly straighten them out and remove all kinks.

The drive is accomplished by double side chains. Brakes are on the rear hubs, ample in diameter and with wide facing. Other details include splash lubrication, thermo-syphon cooling, high-tension magneto and battery ignition, multiple disc clutch, selective-type transmission, and axles of wood, oil treated and trussed.



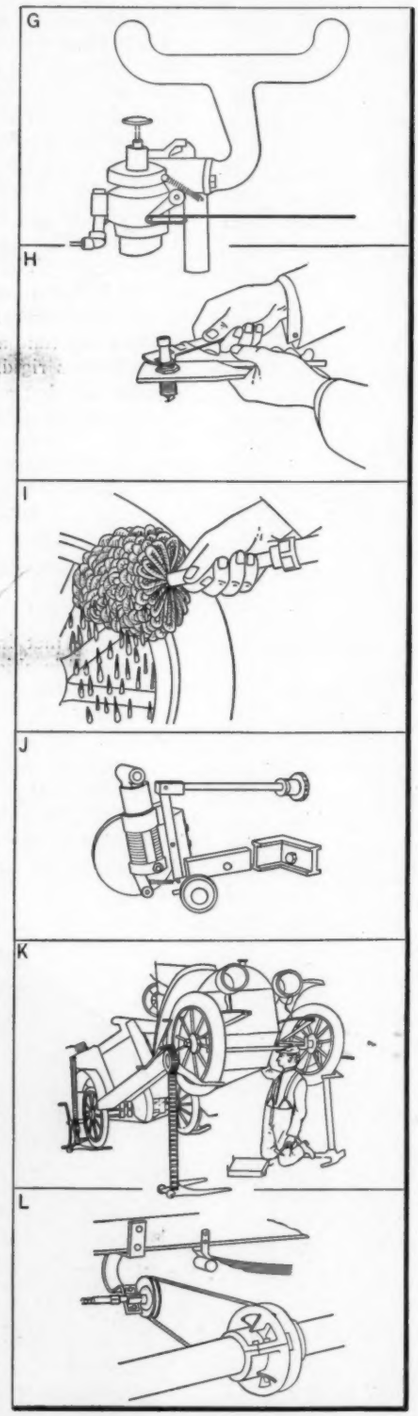
Titan taxicab interior, showing use of rattan, instead of the usual upholstery and floor boards and scuff plates of aluminum

Seen in the Show Window

STARTING a motor is not among the most agreeable phases of an autoist's work, and while cranking is not so formidable to the experienced rider as it seems to the novice, lifting the hood to prime the carbureter may prove exasperating at times. The Hofweber motor starter utilizes the experience that it is easier to start on a rich mixture than on a poor one, and in the illustration (G) is seen the principle of its operation. The device is placed between the carbureter and intake manifold and draws gasoline from the gas pipe through a by-pass valve which is closed when the rod seen in the cut is pulled as it happens while the engine is being started, the rod leading through the radiator to the crank. When the valve is closed a rich mixture is admitted to the cylinder, thus making their starting easy, thereafter the valve opens again directing the gasoline to the carbureter. This device which might be termed an auxiliary carbureter is easily installed; it is the product of the Motor Devices Manufacturing Company, of 316 South Fourth street, La Crosse, Wis.

REMOVING a hot spark plug with your fingers is not the most pleasant of jobs, and therefore the spark plug hand vise made and sold by the Hagstrom Manufacturing Company, of Lindsborg, Kans., will come in handy in all cases where it is necessary to examine and clean a hot plug, especially if it is in a rather inaccessible position. The mode of operation of this accessory is so well illustrated at (H) that no further explanation is needed to make clear its usefulness in one of those situations which again and again confront even the most careful of motorists.

A GOOD-LOOKING car is a beauty and a joy forever, but this state of things cannot be kept up except by regular and untiring effort. If dirt is allowed to stay on the automobile it will make its mark, especially as far as the body is concerned, nor is there any use decrying the fact that a good cleaning extended to the tires at frequent intervals, using water—not oil—for the purpose, cannot help but lengthen their life. To make a disagreeable but necessary act easier to perform the Cataract automobile vehicle washer must be considered as a step in the right direction, and looking at the illustration (I) discloses the simple construction and operation of the device. A substantial metal handle fits into a pipe surrounded by a soft mop. This takes up considerable quantities of water which flows over the body or tire when the washer is applied. The manufacturers are the Cataract Auto Vehicle Washer Company, 324 Topeka avenue, Topeka, Kans.



(G) Showing the principle of operation of the Hofweber Starter

(H) Hagstrom spark plug hand vise saves burnt fingers

(I) How the cataract vehicle washer operates.

(J) Automatic tire pump

(K) An automobile jack that renders the underbody of a car accessible

(L) Speedometer driven off the shaft

UNDERINFLATED tires, while they save the chauffeur work, cost the owner of a car money and money again, and, taking the price of a good tire at $45, there will be few autoists who will decline to insure a considerably increased life of their tires if half the above-named sum will bring about the end. The M. & L. automatic pump (J), driven by the engine of the automobile, has an air-cooled cylinder in which reciprocates a piston fitted with split rings. Friction disc, eccentric and main shaft are made of high-grade material, while the valve moves in a three-point bearing, and a special system of lubrication is used. The pump is built by McCarrell & Hawley, 604 Lippincott building, Philadelphia, Pa.

ACCESSIBILITY is chief among the missing virtues of the underside of an automobile. The garage and repairman who has a daily opportunity to crawl underneath a car in order to inspect it or to work on it will appreciate the advantages offered by the Big Four Auto Jack seen at (K), and it is for him that this equipment is intended. The most novel feature is that the car is held up not under the axle but the tire. The rack-and-pinion idea is applied in this apparatus, the pinion being held securely in place by a locking appliance, while the stability of the whole equipment is warranted by the large base of each of the jack elements. Two or four wheels may be raised and casters attached to the bases permit the easy transport of a car. G. E. Travis Co., of Henry, Ill., have made this advance in jack construction.

SPEEDOMETRY, while it has reached perfection as far as the exactitude of the standard instruments is concerned, is yet subject to some practical refinements of details, last of which has been realized in the latest speed and mileage meter of the Jones Speedometer Company, New York. In this apparatus (L) drive is taken from the propeller shaft of the automobile to which is attached an adjustable pulley furnished with the outfit. The driven pulley is fitted direct to the frame and attached to a spring clip taking up the surplus of belt slack to prevent slipping. The flexible shaft is carried along the frame, and through the footboard leads up to the dashboard, where its motion is translated into the indications and records appearing on the meter.